

## INTRODUCTION

This manual is assembled in the following sequence:

The First Section is a photograph of the component parts of the fixture with a reference letter for each tool. Accompanying the tool plate is a corresponding tool list (page five) that will make tool identification rapid and easy.

The Second Section is the use of the tools required to rebuild a three-cylinder 500S H1 crankshaft, as well as a step-by-step example of the rebuilding procedures for the H1. Also in this section is a parts list for the parts required to rebuild the crankshaft and clearance table with instructions for the use and placement of the dial indicator.

The Third Section is the use of the tools required to rebuild a two-cylinder 250S A1 — 350S A7 crankshaft, as well as a step-by-step example of the rebuilding procedures for the A1 — A7. Also in this section is a parts list for the parts required to rebuild the crankshaft, and a clearance table with instructions for the use and placement of the dial indicator.

Section Four is the use of the tools required to rebuild a single-cylinder 350E F5 crankshaft, as well as a step-by-step example of the rebuilding procedures for the F5. Also in this section is a parts list for the parts required to rebuild the crankshaft, and a clearance table with instructions for the use and placement of the dial indicator.

Section Five is comprised of charts, parts lists, clearance tables and exploded views.

## WARRANTY POLICY

The Warranty Policy is being printed on a parts tag, so the rebuilder will be able to affix the warranty on each rebuilt crankshaft. A supply of the tags, with a reorder form, will be sent directly to each rebuilder's shop by Hammond Publishing Company. Do not reorder policy tags from Kawasaki Motors Corporation.



### WARRANTY POLICY FOR KAWASAKI CRANKSHAFT REBUILDING STATIONS

The rebuilder on his own behalf, warrants to the purchaser that each rebuilt crankshaft shall be free, under normal use and service, from defects in material and workmanship for a period of thirty (30) days from date of installation. This warranty shall be fulfilled by the rebuilder replacing at his place of business, free of charge any such defective rebuilt crankshaft. Labor for installation, loss of use of the vehicle, inconvenience or consequential damages of any type are not warranted.

This warranty expires one (1) year after purchase (regardless of installation date).

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTY.

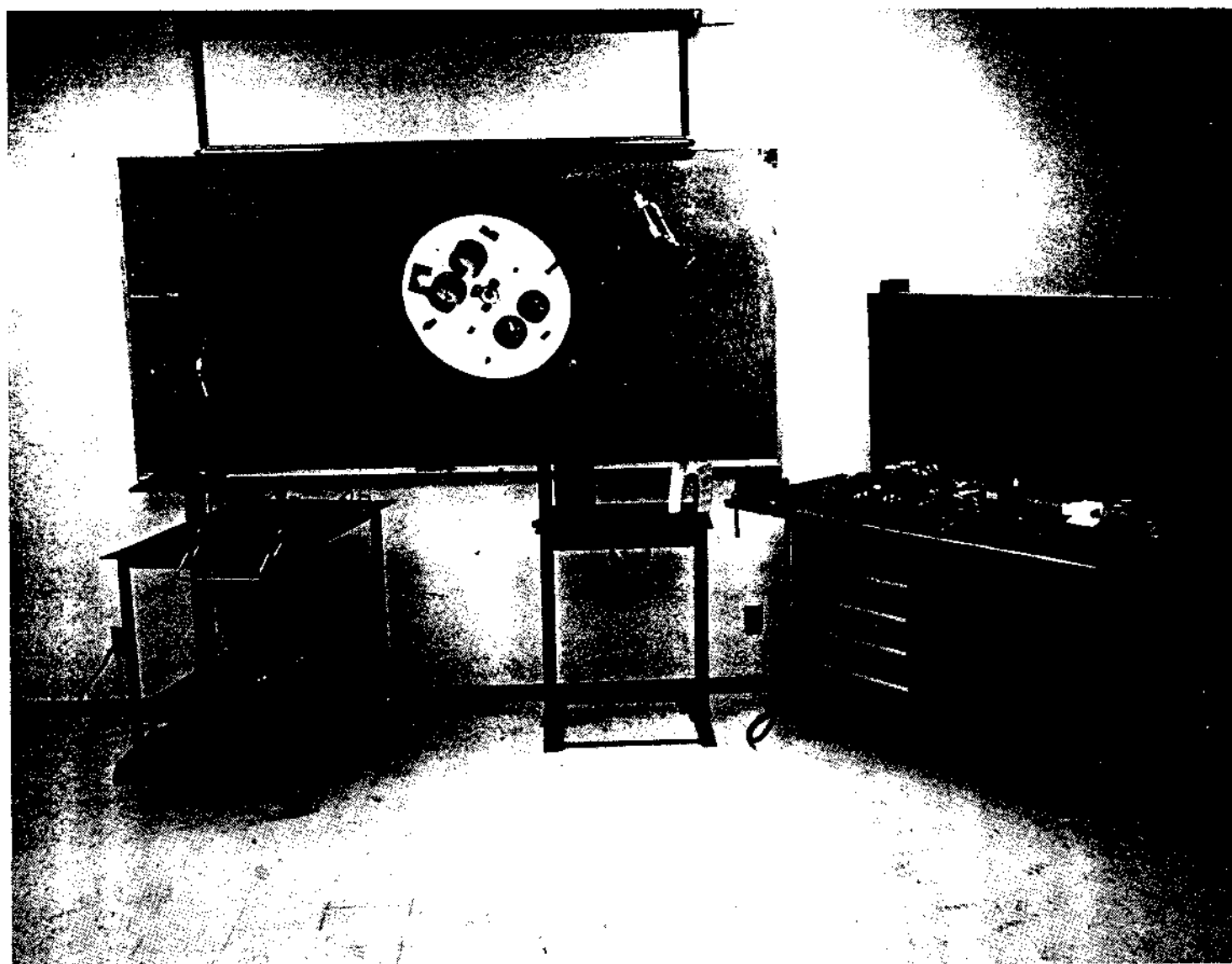
The following list of costs, allowances, and approximate rebuilder profit, was established in a time study program. Parts used were those parts that are considered to be wear items, but did not include such items as the crankshaft halves or crankshaft webs.

This list is offered for your consideration, it is in no way intended to set price or even suggest same, nor does it restrict the builder from establishing his own prices, be they higher or lower. All of the prices are for crankshafts that can be rebuilt.

MODEL	NEW PART DEALER COST	REBUILT DEALER COST	CORE ALLOWANCE	APPROXIMATE REBUILDER PROFIT
H1	\$95.00	\$75.00	\$20.00	\$27.62
			Broken Core	
			10.00	
A Series	62.50	52.50	12.50	15.93
G Series	21.25	18.00	5.00	6.25
C-2	21.25	17.00	5.00	5.75
F-3	23.25	19.00	5.00	6.50
F-4	32.50	21.00	5.00	8.50
F6/F7	27.50	23.50	7.50	7.75
F8/F5	40.00	28.00	7.50	9.75

## REBUILDING STATION

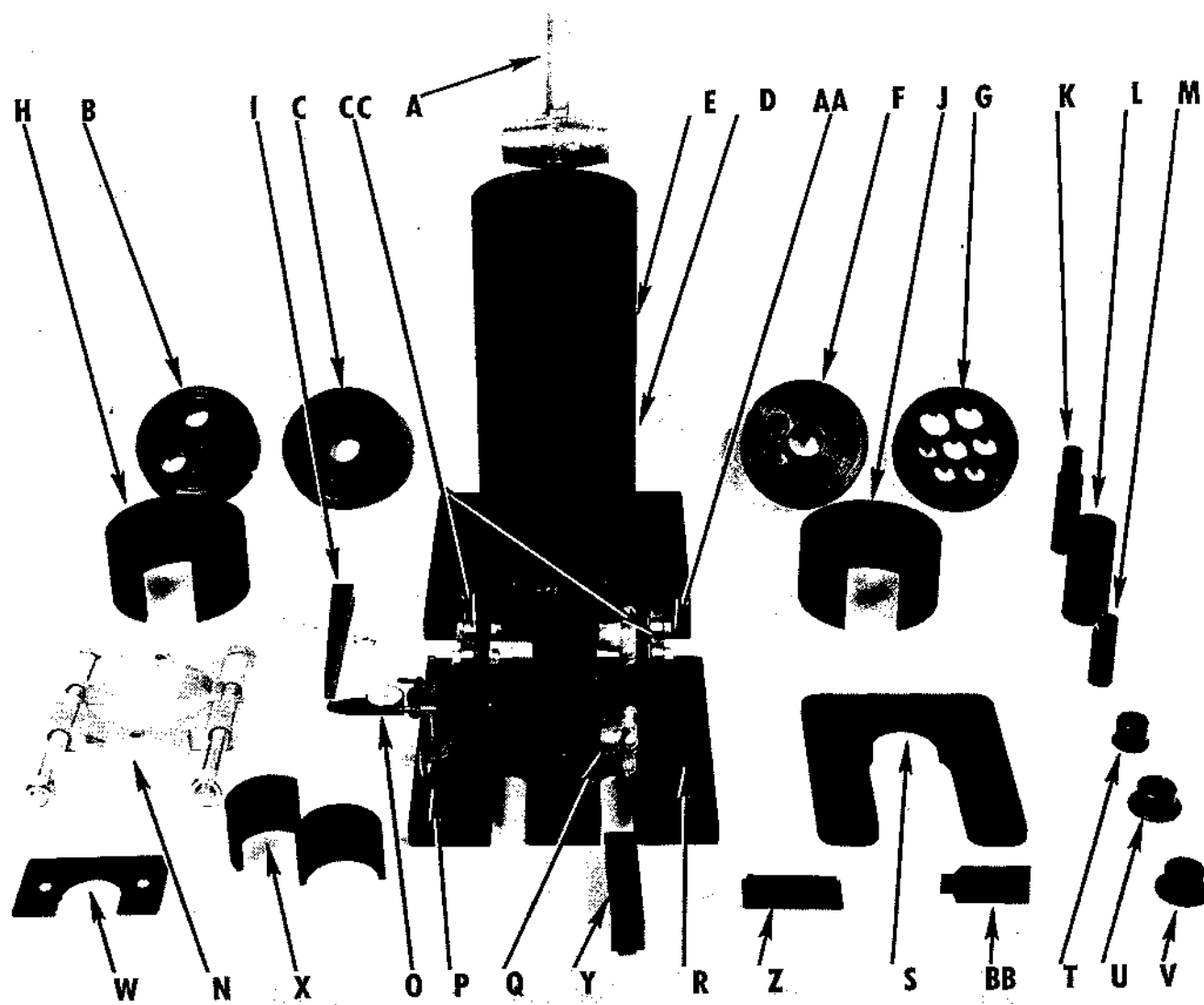
Pictured is a suitable and workable set-up for a rebuilding station within your shop. Total floor space required is an area 10' x 15'. Convenience items such as the tool carousel and parts basket are not included with fixture kit.



## ALL MODEL CRANKSHAFT REBUILDING FIXTURE BASIC KIT PART #99990-300

It is most important before any piece of the crankshaft assembly is removed, that each major component be identified. Please refer to assembly chart, foldout Page Number 16-A. Proper identification of components will help to avoid the loss of parts, and will be most helpful in the re-assembly phases.

To help you locate the tools used in each step, they are identified in each paragraph with the letter used in the master jig parts photo.

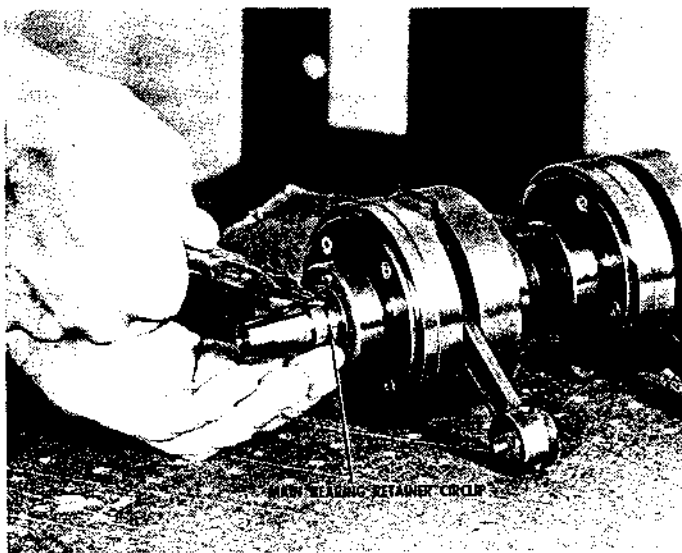


## BASIC KIT IS COMPRISED OF THE FOLLOWING TOOLS

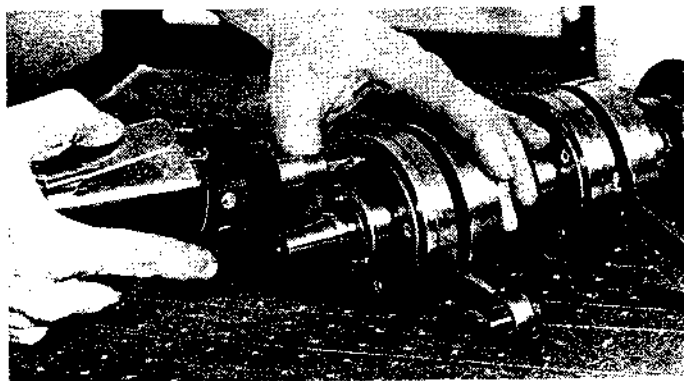
	DESCRIPTION	MODEL USE	PART NO.
A	Lead Hammer	All Models	N/A
B	Upper Indexing Plate & Crank Pin Guide	250S A1 — 350S A7 — 500S H1	99990-306
C	Lower Assembly Plate	All Single Cylinder Models	99990-308
D	Crankshaft Guide	All Models	99990-301
E	Crankshaft Guide Extender	500S H1	99990-302
F	Lower Indexing Plate	250S A1 — 350S A7 — 500S H1	99990-305
G	Crank Pin Guide & Upper Assembly Plate	All Single Cylinder Models	99990-309
H	Flywheel Alignment Tool	250S A1 — 350S A7	99990-304
I	Assembly Gauge	All Models	99990-318
J	Flywheel Alignment Tool	500S H1	99990-303
K	Press Pin	All Models	99990-316
L	Main Bearing Installation Tool	All Models	99990-320
M	Locating Pin for Lower Indexing Plate	250S A1 — 350S A7 — 500S H1	99990-307
N	Proto Bearing Puller	All Models	N/A
O	Dial Indicator	All Models	N/A
P	Magnetic Base	All Models	N/A
Q	Hand Knob w/Stud (2)	All Models	N/A
R	Truing Jig	All Models	99990-313
S	Flywheel Support Plate	All Models	99990-321
T	Bushing — Upper Assembly Plate	G and C Models Only	99990-310
U	Bushing — Lower Assembly Plate — Large Singles	F8 and F5 Models Only	99990-311
V	Bushing — Lower Assembly Plate — Small Singles	Use on all Single Cylinder Models Except G, C, F5 & F8	99990-312
W	C2 Spacer	C2 (Disassembly Only)	99990-317
X	Adapter Bushings (2)	500S H1	99990-314
Y	Support Block	250S A1 — 350S A7 — 500S H1	99990-315
Z	Spacer Bar	500S H1	99990-319
AA	10mm Bolts with Nuts & Washers	All Models	N/A
BB	Press Bar	Universal	N/A
CC	Truing Jig Support Bearings	Single Cylinder Models	N/A

- (1) All tools that have been assigned a part number, and are so listed may be purchased from Kawasaki Motors Corporation on an individual basis.
- (2) Those tools that have not been assigned a part number (ie) N/A can be purchased commercially, from a source in your area.
- (3) As each new model is added to the Kawasaki line, tools for rebuilding the new or different crankshafts, and instructions for them will be sent to you so that you may update this manual.

## 500S HI CRANKSHAFT TOOLS & DISASSEMBLY



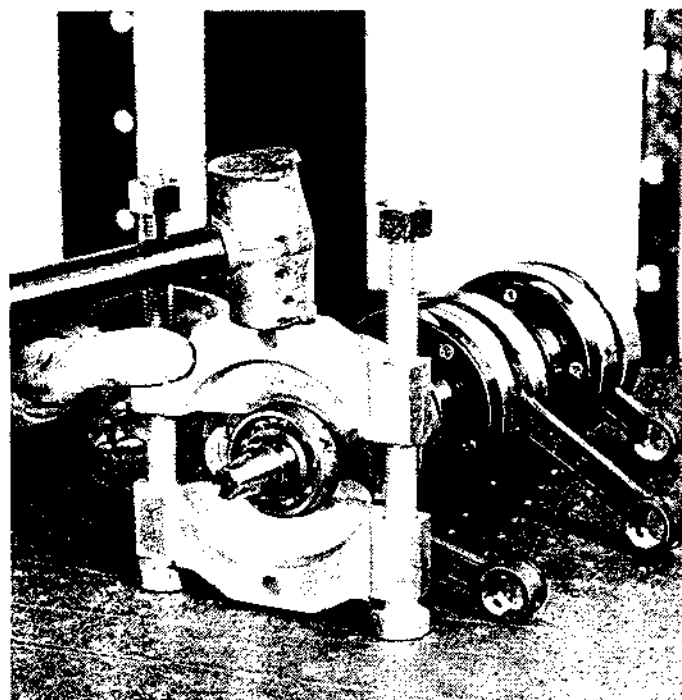
**1**  
Remove left hand outside main bearing retainer circlip.



**2**  
Use a Phillips screwdriver, hand or impact type, and remove (4) Phillips screws from oil receiver, left hand crank-flywheel. Use a blade-type tool and pry off the oil receiver.

NOTE: Oil receivers on the left hand crank and center crank can and should be removed before removing main bearings. This will avoid damage to these two units in the event that they must be used over.

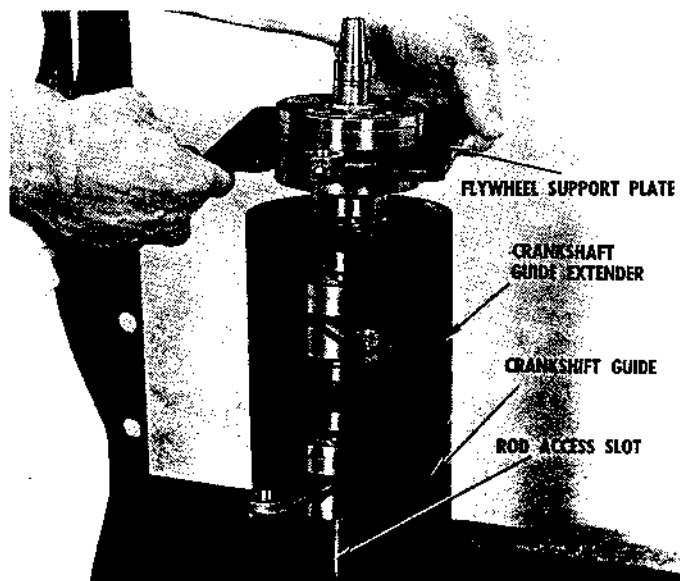
The oil receiver on the right hand crank **cannot** be removed before removal of the main bearings due to the O.D. of these bearings. This oil receiver will in most cases, be damaged during removal of the bearings and must be replaced with a new unit.



**3**  
Remove left-hand outside main bearing, using the bearing puller (tool N). Place puller so that the thin blade area of puller is in a position to close between bearing and flywheel. Hold crankshaft assembly with bearing puller in place and position as shown in photo. With a lead hammer, strike a sharp blow on the edge of the bearing puller, this will loosen bearing and seat the blades of the bearing puller between the main bearing and the flywheel. Thread the nuts of the bearing puller all the way down to secure both halves of puller. Continue to press bearing off of the crankshaft.

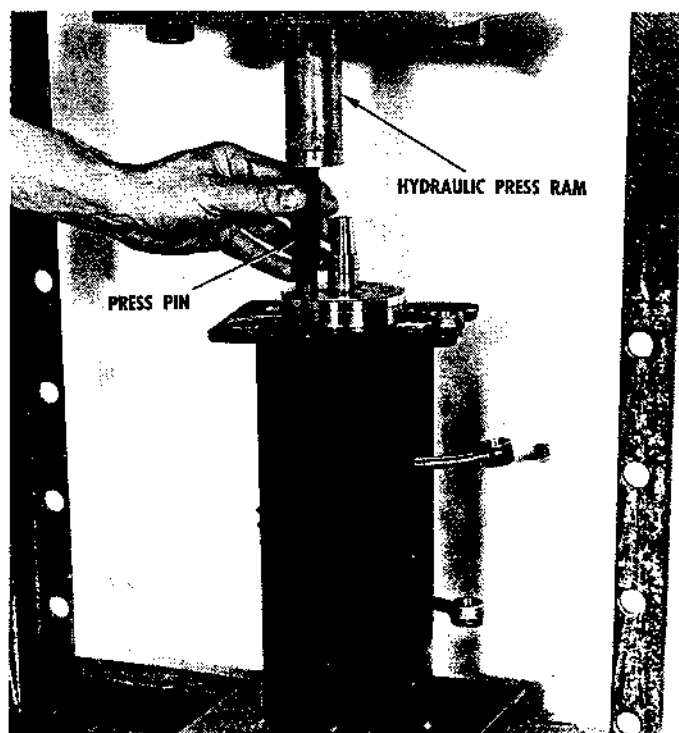


**4**  
Place the flywheel support plate (tool S) between the flywheels of the left-hand crank assembly. (Position the support plate so that the big end of the connecting rod is at the closed end of the rod access slot in the support plate.)



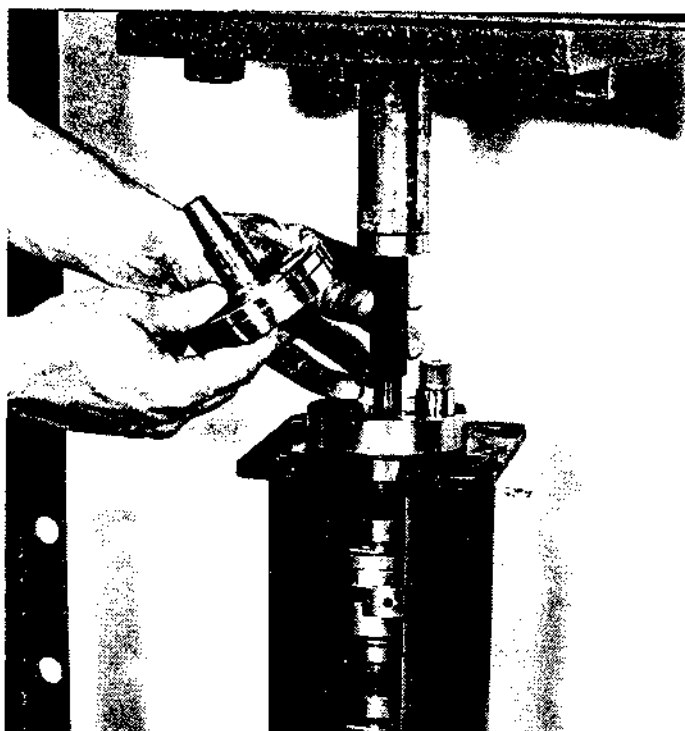
5

Select the crankshaft guide (tool D) and the crankshaft guide extender (tool E), place the extender on top of the crankshaft guide, align the connecting rod access slots and locating pins and press together. Place crankshaft assembly, with support plate in position, (make sure to position all rods to fit rod access slot) into the crankshaft guide as shown. **CAUTION:** A suitable cushioning material (rags-shop towels) should be placed in the bottom of the crankshaft guide, this will prevent damage to the end of the crank when the crank falls during the pressing operation.



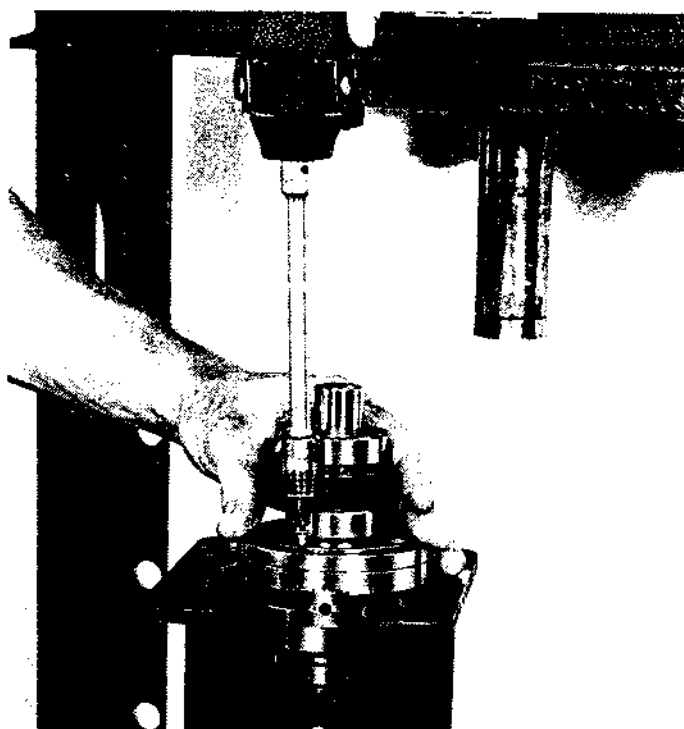
6

Select the press pin (tool K), place crankshaft guide with crank assembly, in an aligned position beneath the hydraulic ram of the press, place press pin in position on the left-hand crank pin (as shown) and press out.



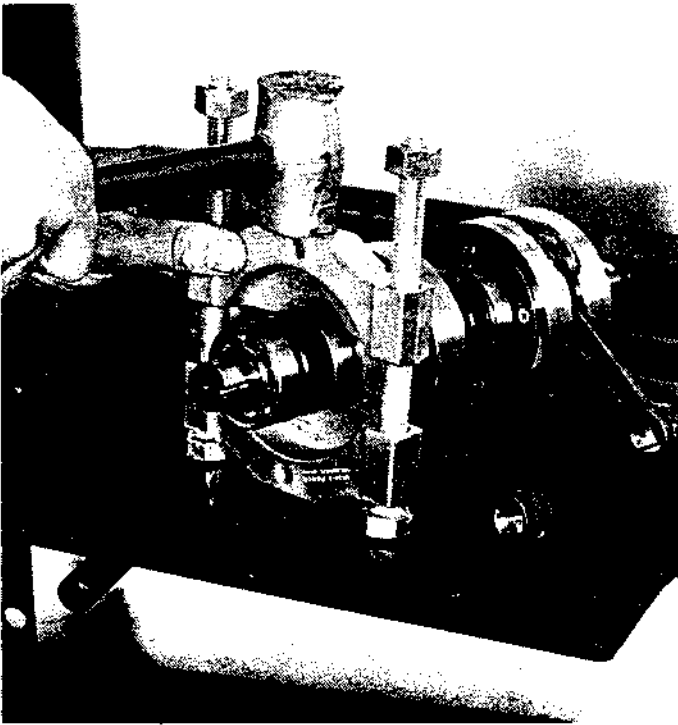
7

Remove left-hand crank flywheel, and move the flywheel support plate to the next flywheel (as in photo). Remove connecting rod, bearings and spacers. Place press pin in position and press out the center crank with left center main bearings.



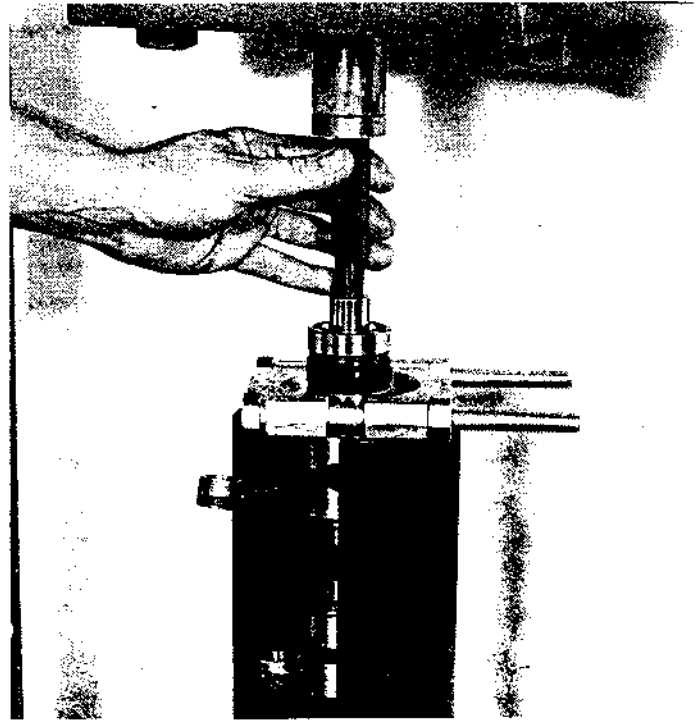
8

Remove four (4) Phillips screws from oil receiver, remove oil receiver, the oil receiver may be loosened by prying with a sharp bladed tool.



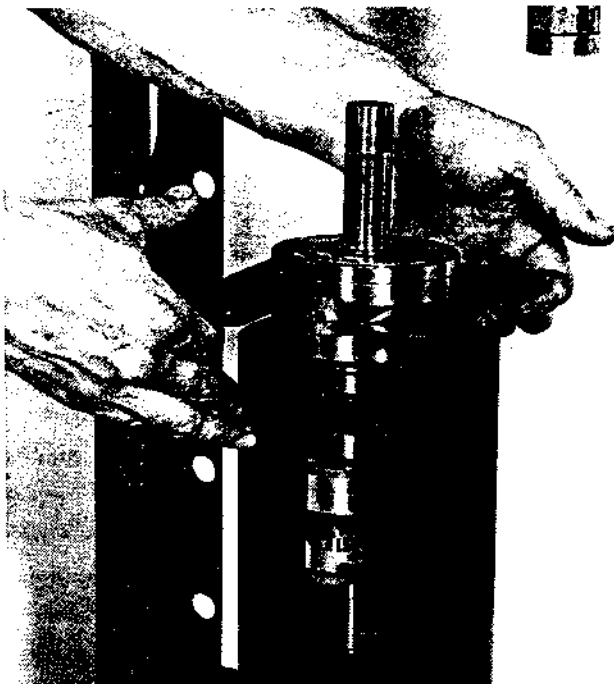
9

Remove left-hand outside bearing, using the bearing puller (tool N). Place puller so that thin blade area of puller is in a position to close between bearing and flywheel. Hold crankshaft assembly with bearing puller in place, and position as shown in photo. With a lead hammer, strike a sharp blow in the edge of the bearing puller; this will loosen bearing and seat the blades of the bearing puller between the main bearing and the flywheel. Thread the nuts of the bearing puller all the way down to secure both halves of puller. Continue to press bearing off of the left-hand crankshaft.



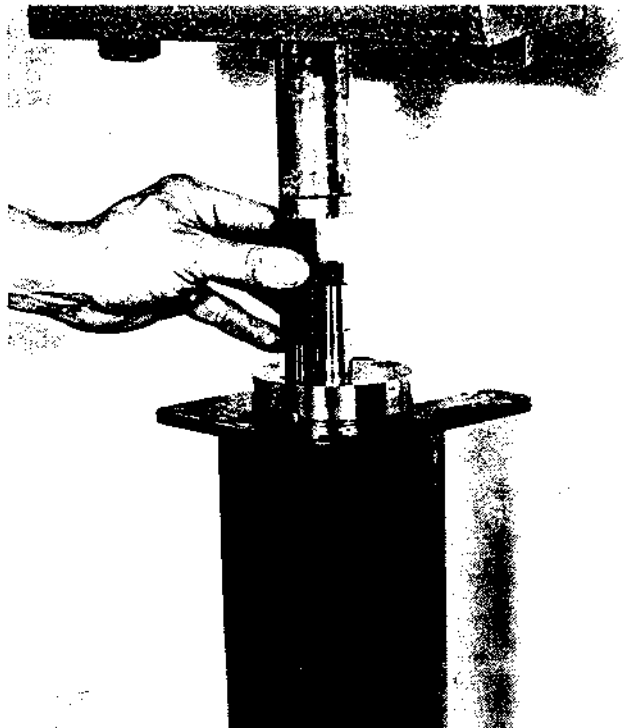
10

If additional pressing is required, thread the hex nuts of the bearing puller to lock position, as shown. Place the crank assembly with the bearing puller in the crankshaft guide, and use the press pin (tool K) to continue removal.



11

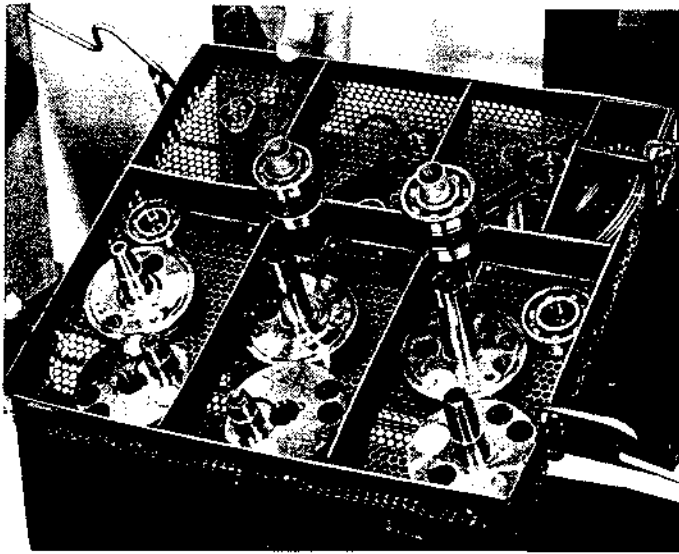
Reposition the flywheel support plate under the center crank and continue removal process as before. This sequence is followed until all units have been pressed apart.



12

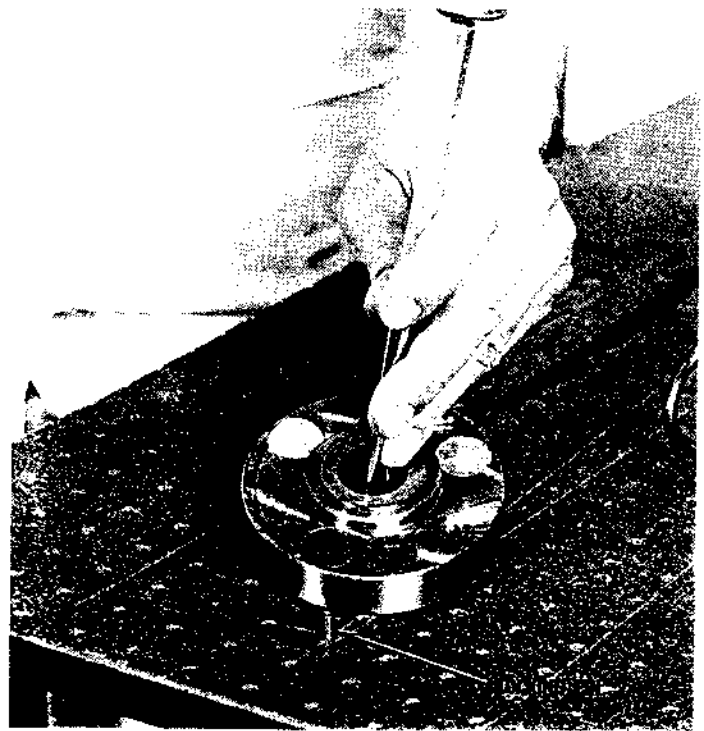
After all units have been pressed apart, it is necessary to press the crank pins out of the three crankwheels.





13

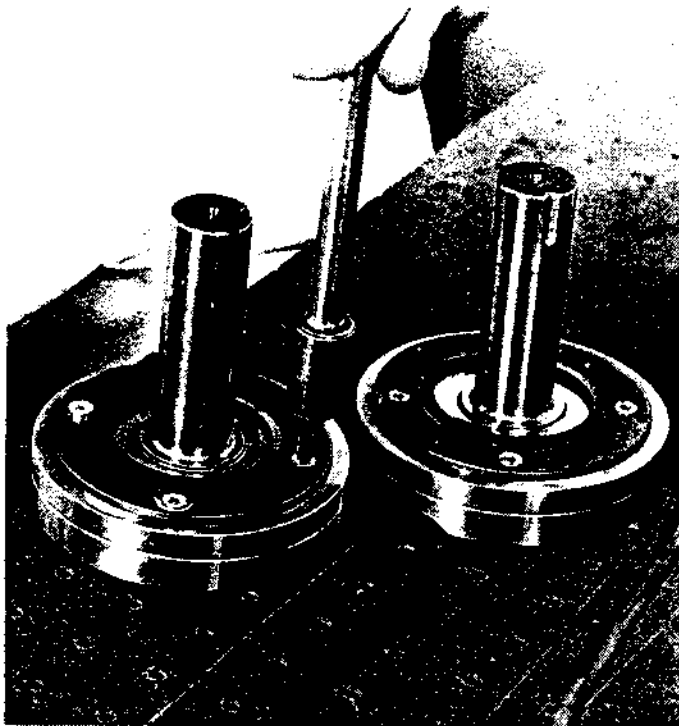
Parts must be kept grouped in the alpha-numerical sequence in which they were disassembled. A parts-washer basket of the type pictured is perfect for this purpose. The part-washer basket is a convenience item not included in the fixture kit.



14

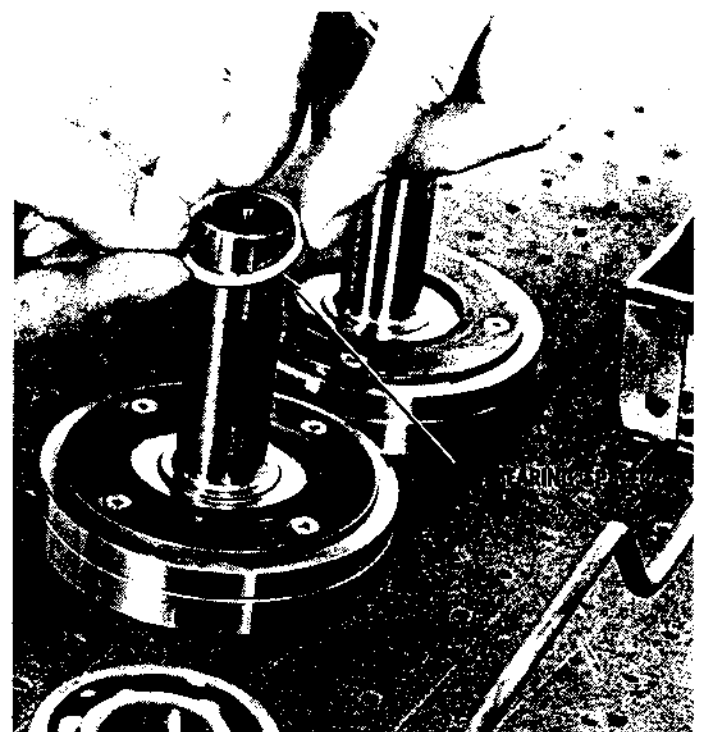
Remove the 5 X 12 mm dowel pins (2) from the crank-wheels as shown. Assembly cannot be accomplished if these pins are left in. CAUTION: All sharp edges must be burred.

## 500S HI CRANKSHAFT ASSEMBLY



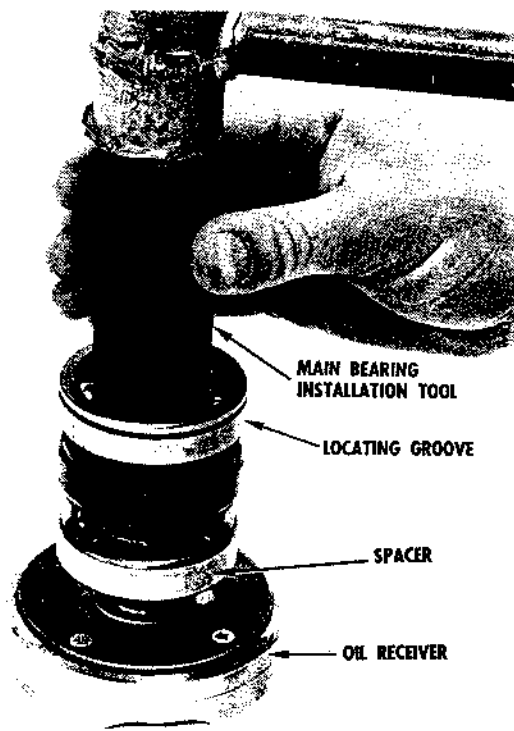
1

Assemble the crankshaft oil receivers with the crank-wheels. NOTE: Apply Loc-tite to all screws as they are installed. CAUTION: Do not install left hand outside oil receiver at this time. CAUTION: New screws must always be used. All screws must be staked to safety lock.



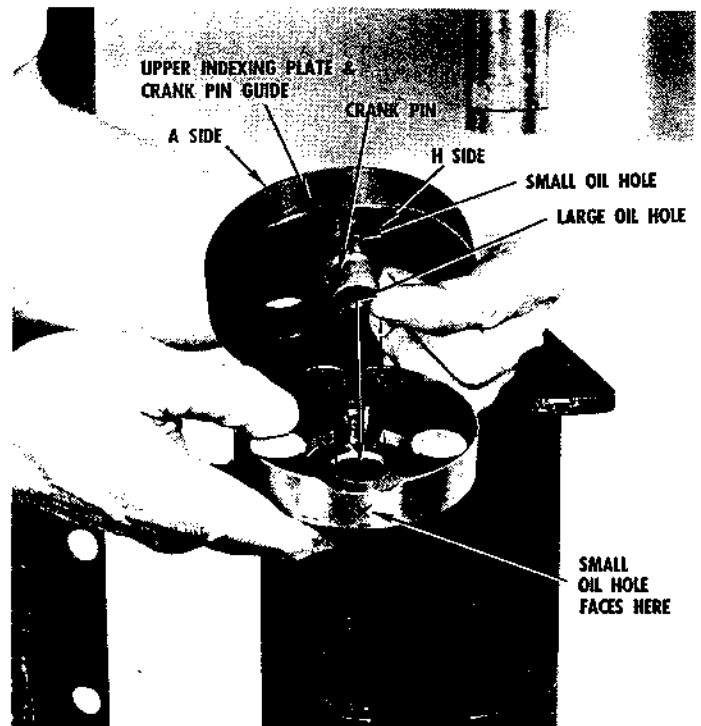
2

Install the main bearing spacer, Part Number 92026-066. NOTE: If this spacer is left out, spacing and clearance will not be correct. CAUTION: This spacer must be installed with cup side down.



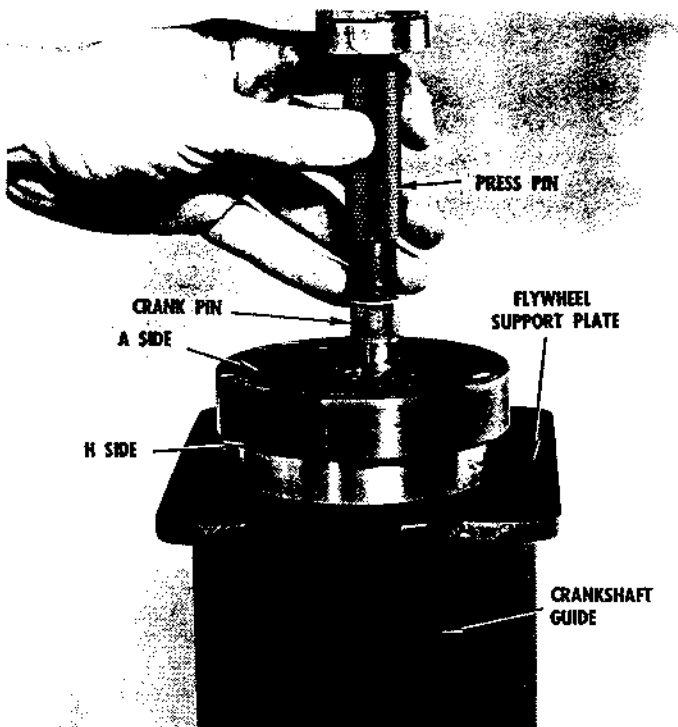
3

Use main bearing installation tool (tool L) and install main bearings as shown in photo. CAUTION: Be sure that locating groove on main bearing is in proper location. NOTE: Pack seals and bearings with a suitable hi-temp grease.



4

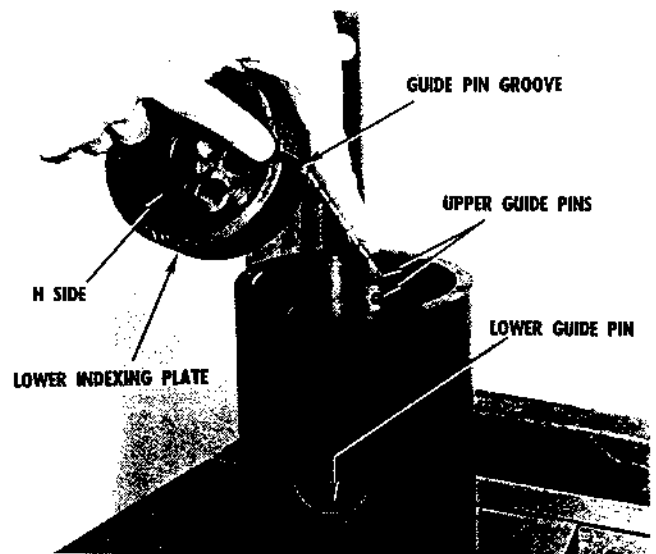
Select upper indexing plate and crank pin guide (tool B) and select the crank pin with large oil hole end of crank pin pressed into crank web. Small oil hole is located on the center line of crank web, pointing to the outside of the crank web. Replace crank pin in center crank and left hand crank. NOTE: Do not replace right hand crank pin at this time.



5

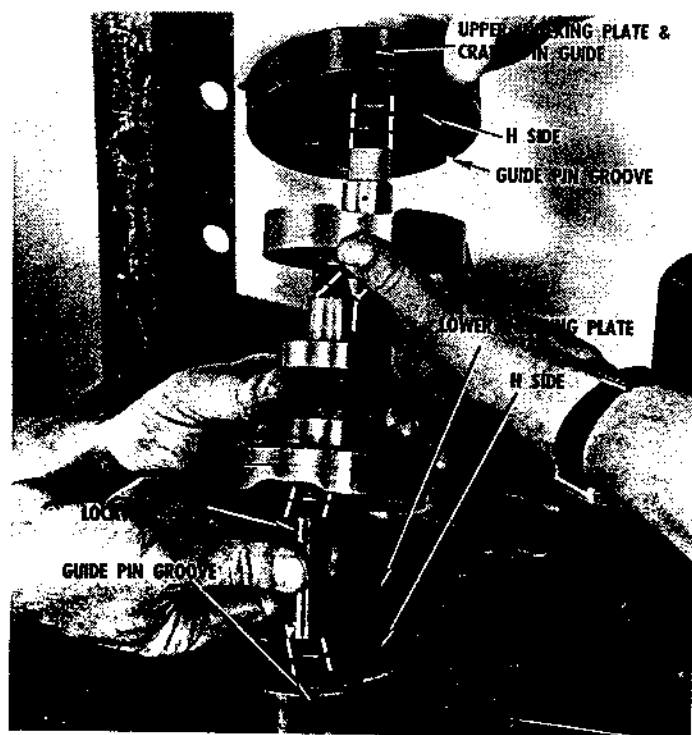
Place crank web, crank pin and upper indexing plate and crank pin guide (tool B) in position on flywheel support plate (as shown in photo) and press in. NOTE: Shoulder of crank pin must bottom on crank web.

PAGE 10

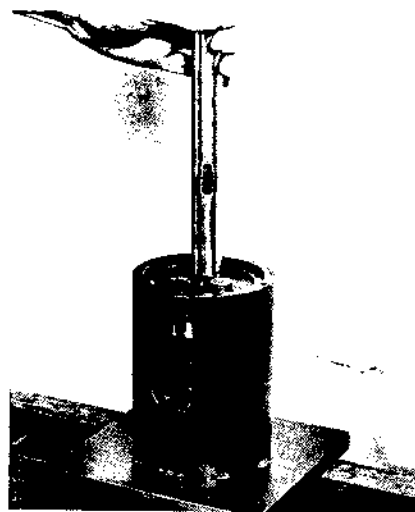


6

Select (tool F) lower indexing plate and (tool B) upper indexing plate. Examine both plates carefully, each plate has the letter H stamped on one side, and the letter A stamped on the opposite side. The letters are stamped next to the hole that is used to index the crankshaft being worked on. There is a difference in the size of the counterbore, the H side is the larger counterbore and is used for H1 assembly only. NOTE: Initial assembly steps require only the crankshaft guide (tool A) be used; the crankshaft extender (tool E) is required only for the installation of the outside main bearing.



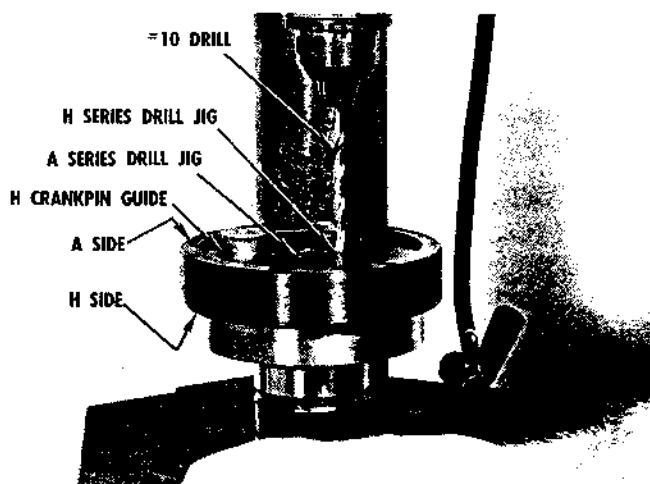
**7**  
Place lower indexing plate (tool F) in crankshaft guide, large counterbore H side up, making sure that the guide pin groove engages the lower guide pin, and that the lower indexing plate sits flush with the bottom. Place the locating pin (tool M) in position, the small diameter fits the hole identified with an H as shown in the photo. NOTE: Crankshaft guide will have been shipped to you with guide pins installed, but not extending into the inside diameter of the crankshaft guide. Make sure that guide pins extend far enough to engage the guide pin slots in the upper and lower indexing plates but not far enough to interfere.



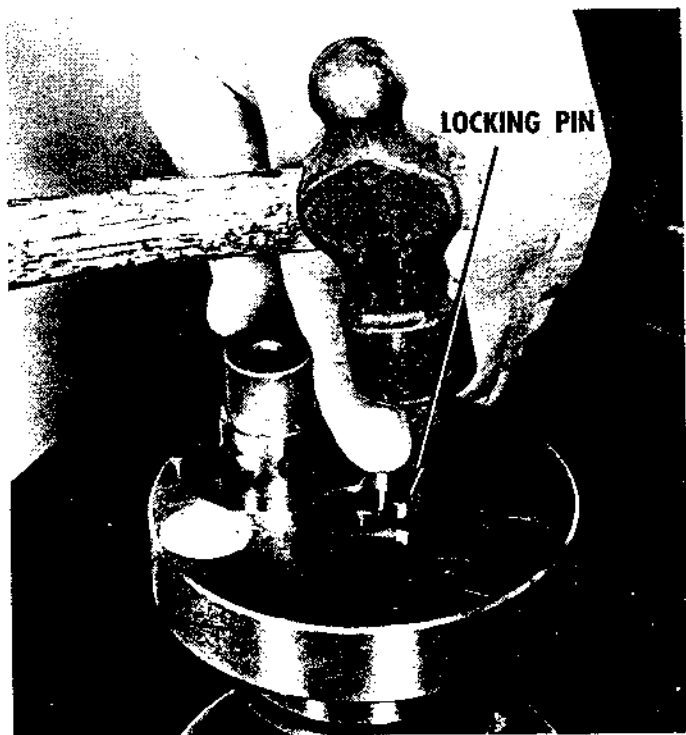
**9**  
A common piece of bar stock (12" X 1½") is used for this pressing operation. Since the extender tool is not used for assembly operations, it would require that the press table be adjusted three (3) times during assembly and disassembly. Press assembly together. NOTE: Crank web must bottom out on the inner races of main bearing. (Add slight pressure after bottoming to insure contact mating). Follow the same assembly steps for the right hand assembly as were used for the left hand assembly.



**8**  
Place left center crank and main bearing assembly in position, the crank pin hole over the locating pin, and the O.D. of the crankwheel fitting in the counterbore of the lower indexing plate. Place left center crank web in position, with upper indexing plate and crank pin guide (H side down) mated to left center crank web as shown, place in crankshaft guide, be sure that upper indexing plate guide pin groove engages the two (2) upper guide pins.

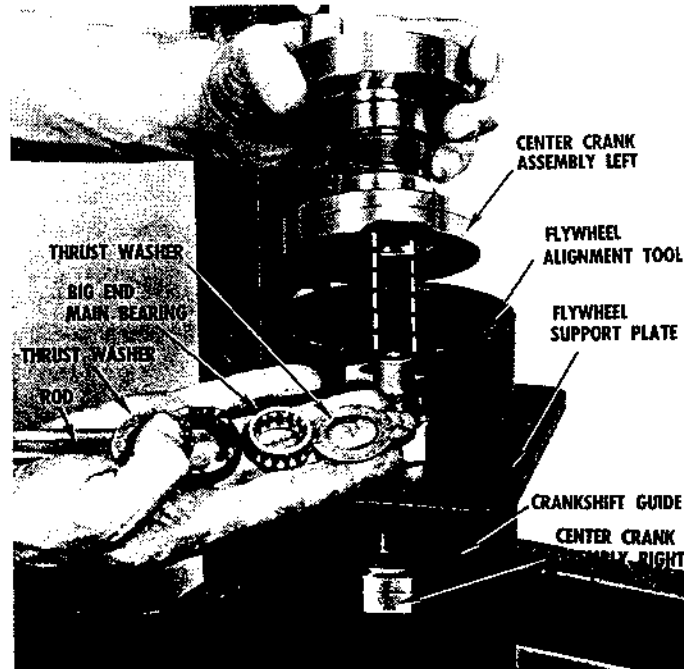


**10**  
If new crank center is used it will be necessary to drill the locking pin hole. The upper indexing plate and crank pin guide (tool B), also serves the purpose of a drill jig to locate and drill the locking pin hole. NOTE: When new, the jig holes are not full size. The first time the jig is used care must be taken to insure a smooth drilling operation. NOTE: Drill size is a #10. NOTE: Do not attempt to drill already drilled cranks. Drill to a depth of 13 mm (.562 in.)  
The drill jig hole for the A1-A7 locking pin hole is located on the center line of the crank pin hole — opposite the A1-A7 crank pin hole.  
See Photo. NOTE: Not a locating hole, locking only.



11

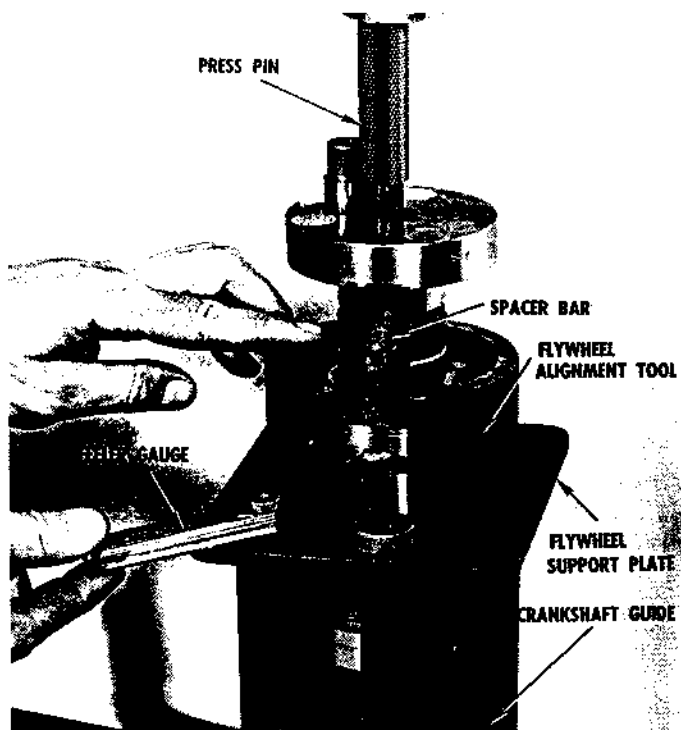
Install locking pins, start pin with a hammer and seat in the locking pin hole with a punch. NOTE: Stake locking pin in position.



12

Place the flywheel support plate (tool S) under the center crank of the right hand crank assembly and position in the crankshaft guide (tool E). Place the flywheel alignment tool (tool J) over the center crank, with connecting rod access slot at the crank pin position. Seat the flywheel alignment tool on the flywheel support plate. NOTE: Because of production tolerances in production of crankwheels, there may be some differences in the fit of the flywheel alignment tool.

Install thrust washer, big end rod bearing, connecting rod and thrust washer on the crank pin. Install center crank assembly (left hand) in the flywheel alignment tool, with crank pin hole in position to press on the crank pin-rod assembly.



13

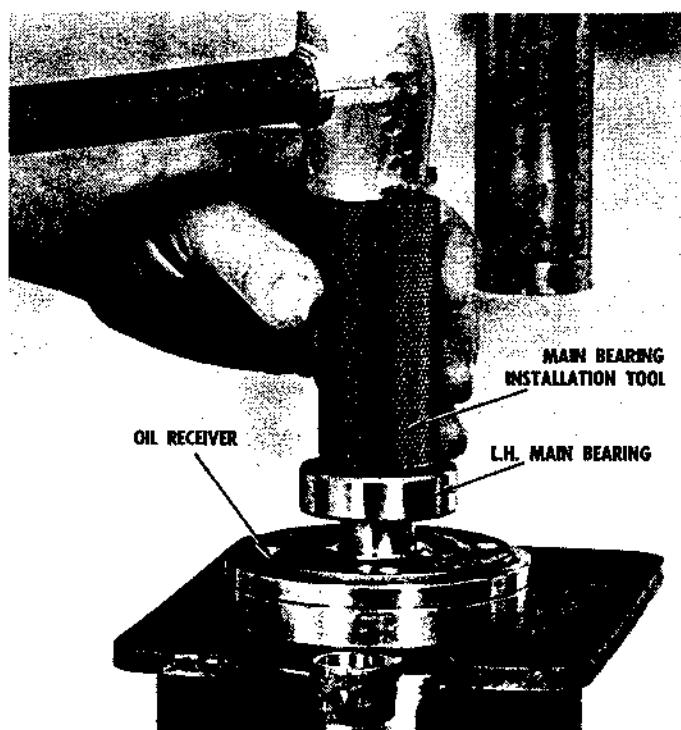
Place the spacer bar (tool Z), in position between the flywheels of the left hand center assembly (as in photo). Position assembly stack in an aligned position under the ram of the hydraulic press. Place the press pin under the ram on the surface of the flywheel. Place a feeler gauge in position to establish big end side clearance and press assembly together. Big end clearance is 0.40-0.55 mm (0.016-0.022 in.) for the 500S H1.

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14

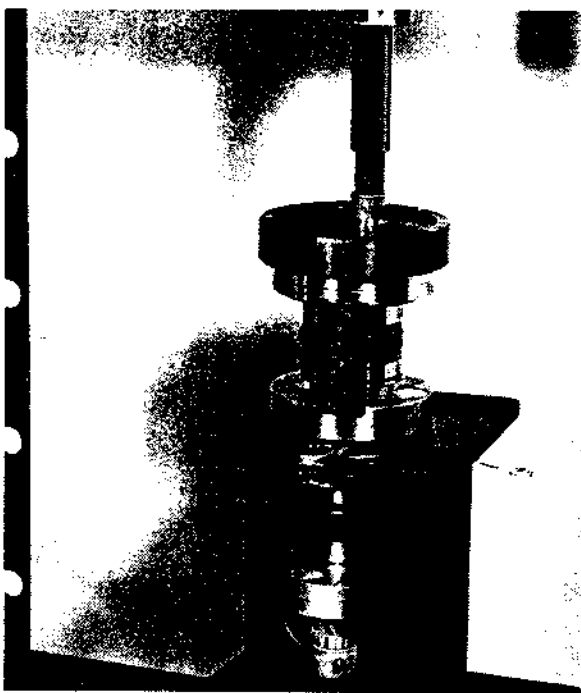
Slide the flywheel alignment tool up to a position as shown in the photo, leave the spacer bar in the same position as for the last operation. Install left hand con rod assembly as before. Position left hand crank so that crank hole will engage crank pin, use the main bearing installation tool (tool L) for this pressing operation. NOTE: As previously noted, the oil receiver for this crank was not installed with the other two. This pressing operation would damage the oil receiver if it had been installed. Place feeler gauge in position to establish big end clearance as before and press together.



15

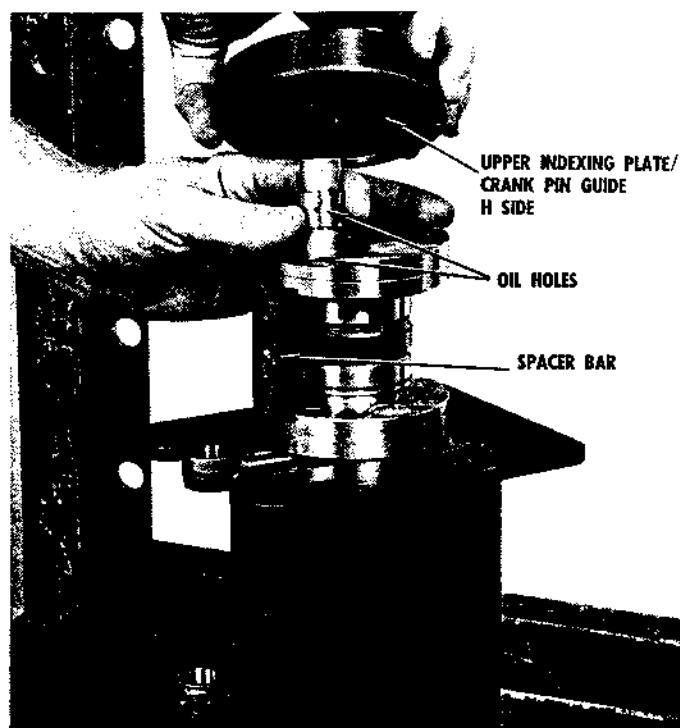
Remove the flywheel alignment tool, position the flywheel support plate between the left hand flywheels (as in photo). Install the left hand crank oil receiver and four (4) Phillips screws (with Loc-tite). **\*CAUTION: New screws must always be used.**

All screws **must be staked** to safety lock. Install left hand main bearing with main bearing installation tool (tool L). Install main bearing retainer circlip.



17

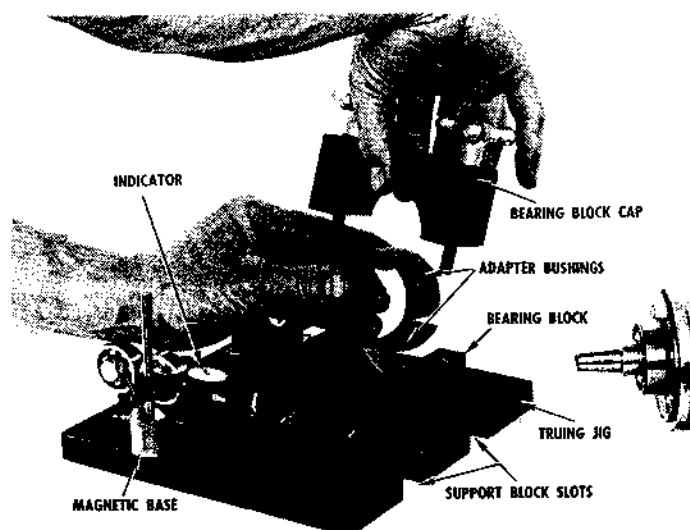
Position assembly stack in place under hydraulic ram; put the upper indexing plate/crank pin guide (tool B) in position and press in the crank pin (shoulder of crank pin must bottom on surface of flywheel). Select the flywheel alignment tool (tool J) and continue assembly operations previously described for the rod assembly, right hand crank and main bearing.



16

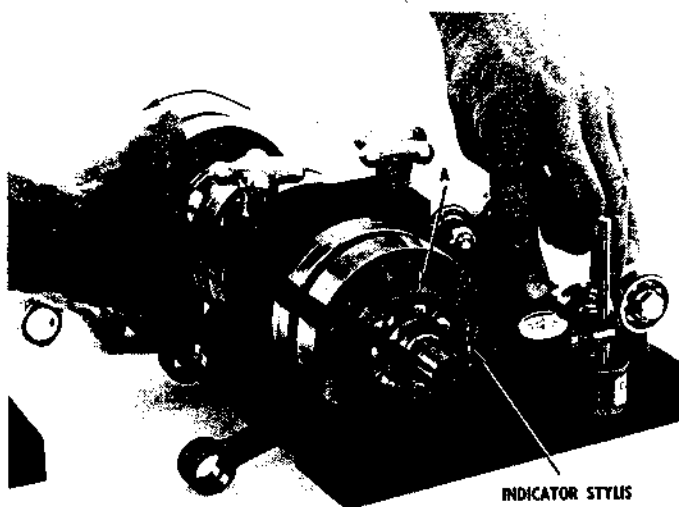
Remove the crankshaft assembly from the crankshaft guide. Place the flywheel support plate under the right hand crank center and place in the crankshaft guide with the crankshaft assembly in a reverse position from previous operation. Place the spacer bar in position (as shown) between the crank center and the right hand crank. Select previously removed crank pin (or crank pin from new assembly) and place in position for installation, take care that the oil holes are aligned as previously described.

# 500S HI CRANKSHAFT TRUING PROCEDURES



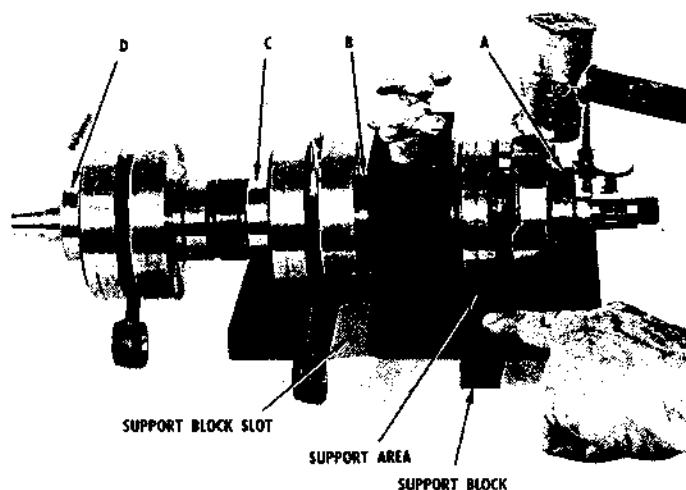
**1**

The truing jig (tool R) is used to check the crankshaft run-out. In using the truing jig to check an H1 crankshaft, the jig is used **with** and **without** the adapter bushings (tool X (2)). When checking the right hand main bearing, the jig is used without the adapter bushings; and when the jig is used to check the left hand main bearings, the adapter bushings must be used. NOTE: The bearing block and the bearing block cap were line bored as a single unit. The bearing block and bearing block cap have been stamped with matching numbers and must be used with the number facing the same direction. CAUTION: In the event that two (2) fixture kits are being used, be careful not to switch bearing block caps.



**2**

Place crankshaft assembly main bearings in bearing block and secure with bearing block cap. Tighten bearing block cap firmly with the hand knob w/stud (tool J (2)). Position indicator stylis as shown in photo, and then achieve a zero reading on the indicator dial that is midway within its range. Rotate crankshaft to establish if assembly is true, or if adjustment is required to correct an out-of-tolerance runout condition. NOTE: Rotate crankshaft in direction indicated to achieve correct indicator readings.



**3**

To adjust crankshaft for an out-of-tolerance runout condition, place support block (tool Y) in the support block slot, under the flywheel as indicated by support area in the photo. Apply adjustment pressure with lead hammer on the flywheel indicated in photo. Check T.I.R. of bearings "A" and "C" when crank assembly is held in jig with right center main bearings. Check T.I.R. of bearings "B" and "D" when crank assembly is held in jig with left center main bearings (adapter bushings used).

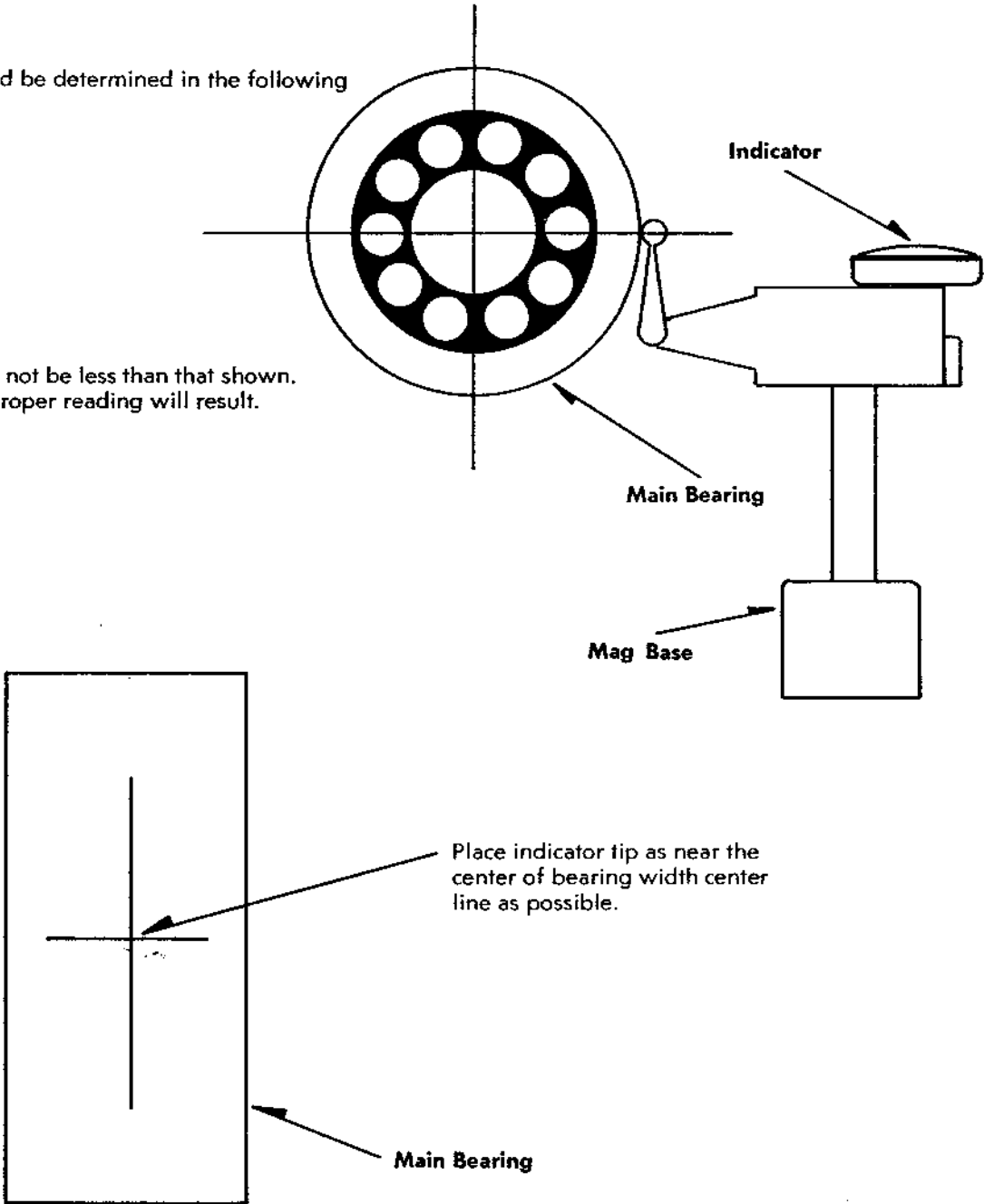
500S HI CRANKSHAFT

CLEARANCE TABLE

BIG END SIDE CLEARANCE	BIG END RADIAL CLEARANCE	RUNOUT OF CRANKSHAFT
0.40 — 0.55 mm	0.004 — 0.12 mm	0.0008 in. (0.02 mm)
0.0157 — 0.0220 in.	0.00016 — 0.00047 in.	Max. 0.0024 in. (0.06 mm)

\*Crankshaft runout should be determined in the following manner:

Angle of indicator should not be less than that shown. If angle is not proper improper reading will result.

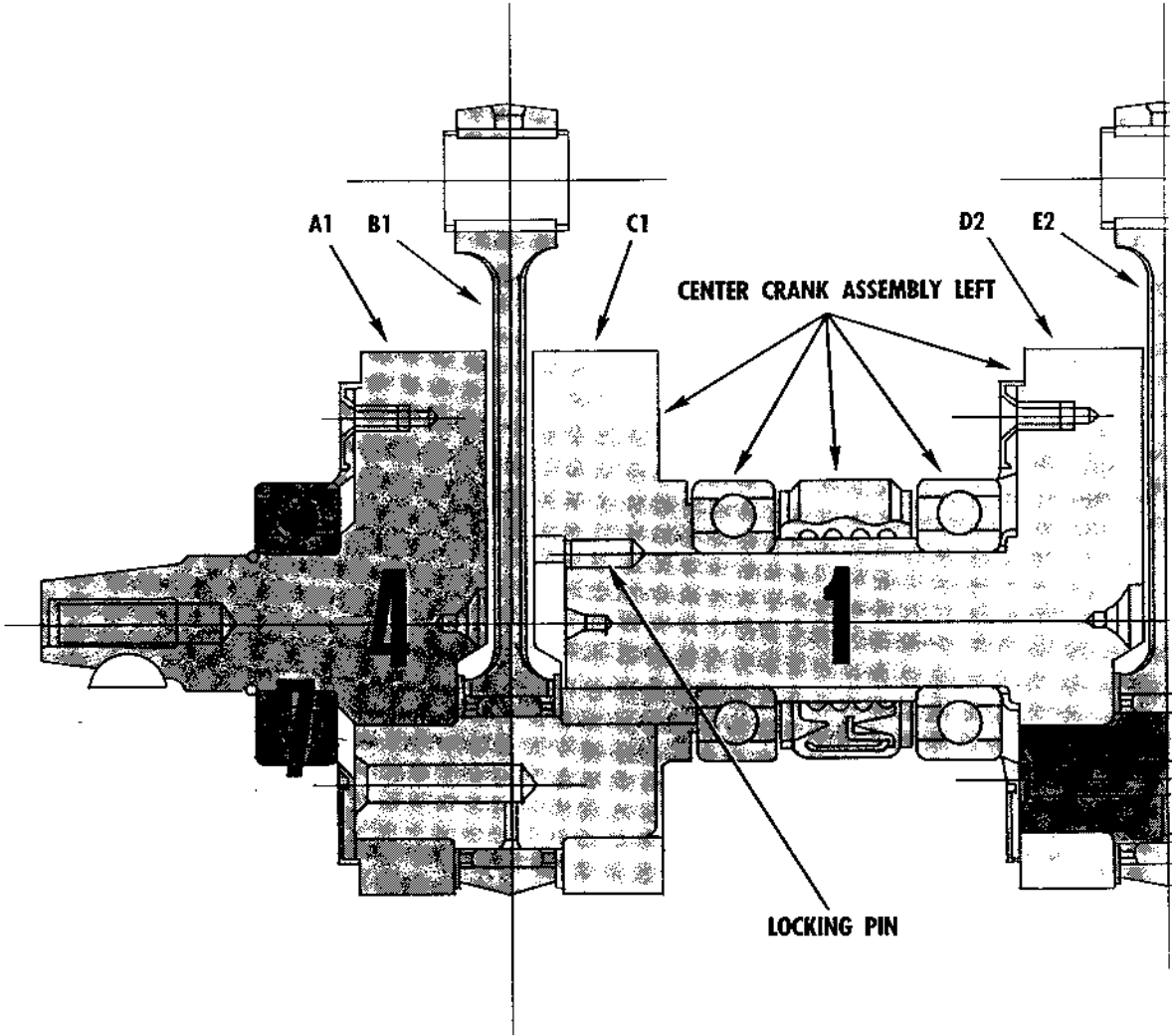


These prices are subject  
to change without notice.

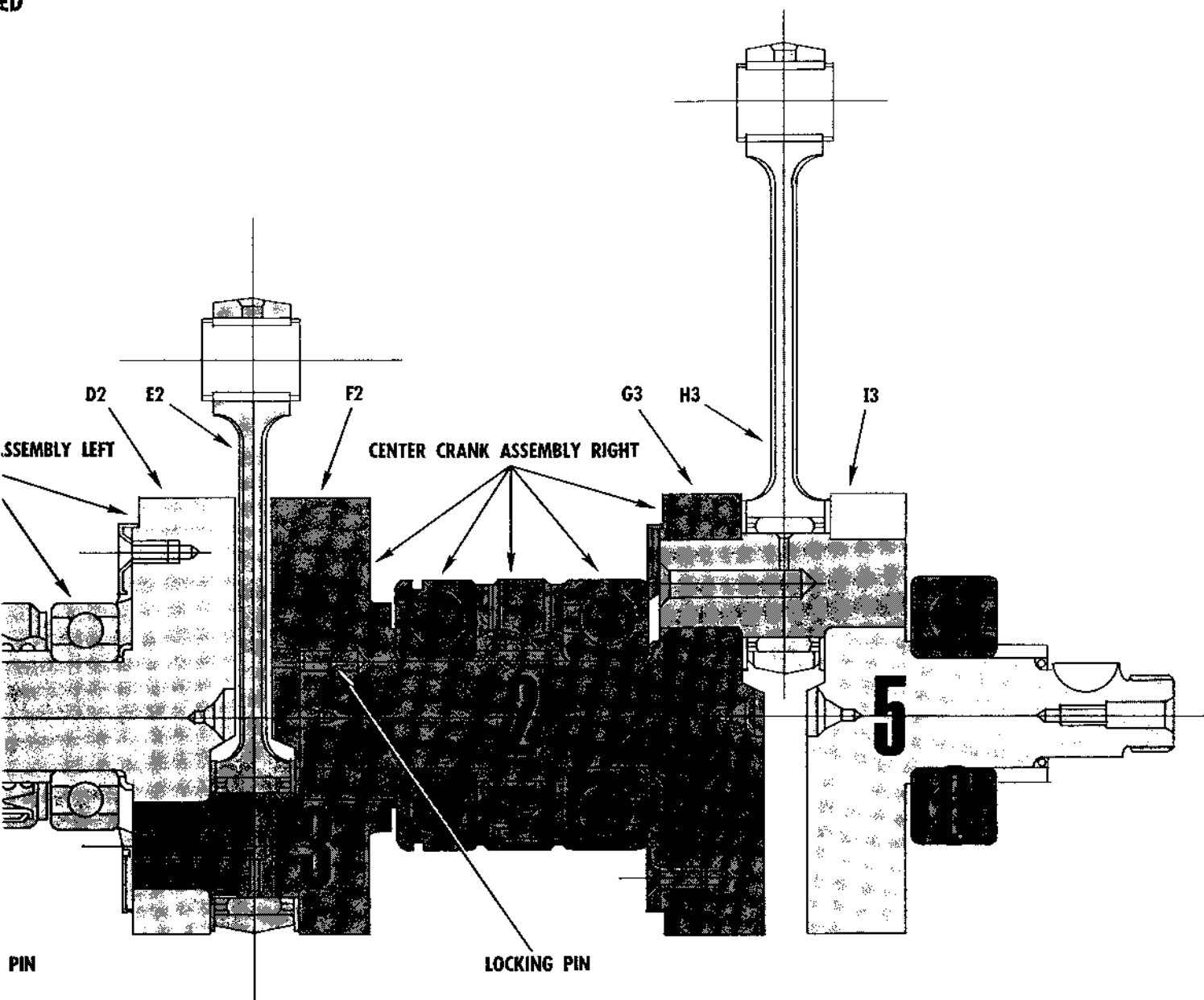
NOTE: ASSEMBLY FOLLOWS THE NUMERICAL SEQUENCE INDICATED

Dealer Price
6.08 NET
7.84 NET
6.08 NET
6.08 NET
5.60 NET
1.13
0.64 NET
0.80 NET
0.99
1.31
1.31
0.03
0.78 NET
0.02
0.07
1.13
0.13
0.07
0.63
0.53 NET
0.58 NET
0.09
0.06 NET

FOLD OUT PAGE FOR COMPLETE DIAGRAM OF 500S HI CRANKSHAFT







# 500S HI CRANKSHAFT PARTS LIST

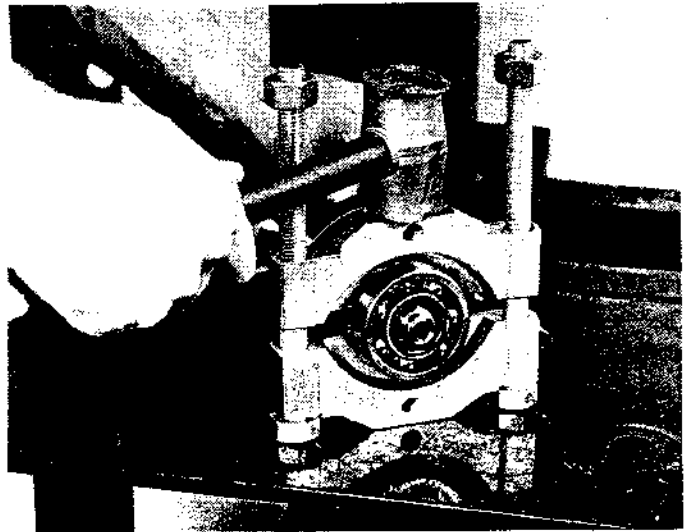
These prices are subject  
to change without notice.

ITEM	PART NUMBER	DESCRIPTION	QTY.	Dealer Price
1	13037-032	Crank L. H.	1	6.08 NET
2	13040-006	Crank Web Center	2	7.84 NET
3	13039-006	Crank Center	2	6.08 NET
4	13038-026	Crank R. H.	1	6.08 NET
5	13044-014	Con Rod Set Pin-Thrust washers & Big End Bearing	3	5.60 NET
6	13033-016	Needle Bearing	3	1.13
7	92054-005	Oil Seal	1	0.64 NET
8	92054-006	Oil Seal	1	0.80 NET
9	601B6205	Bearing	3	0.99
10	92045-002	Bearing	1	1.31
11	601B6305	Bearing	2	1.31
12	92036-013	Circlip	1	0.03
13	13045-005	Oil Receiver	3	0.78 NET
14	92012-001	Screw C/S 5 x 1	3 x 4 (12)	0.02
15	610A0612	Pin, Dowel 5 x 12	2	0.07
16	13034-010	Needle Bearing, Big End	3	1.13
17	510A5200	Woodruff Key	1	0.13
18	92055-018	"O" Ring 22mm	1	0.07
19	92027-031	Collar, Crankshaft Oil Seal	1	0.63
20	92027-077	Collar	1	0.53 NET
21	92027-078	Collar	1	0.58 NET
22	92038-001	Woodruff Key	1	0.09
23	92026-066	Spacer	2	0.06 NET

## 250S A1 350S A7 CRANKSHAFT TOOLS & DISASSEMBLY

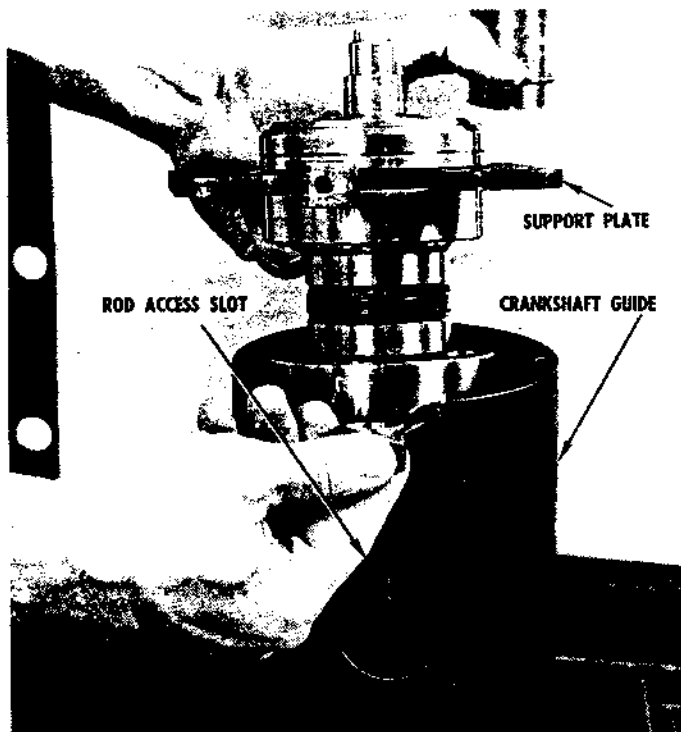
It is most important before any piece of the crankshaft assembly is removed, that each major component be identified. Please refer to assembly chart, Page Number 25. Proper identification of components will help avoid the loss of parts, and will be most helpful in the re-assembly phases.

To help you locate the tools used in each step, they are identified in each paragraph with the letter used in the master jig parts photo.



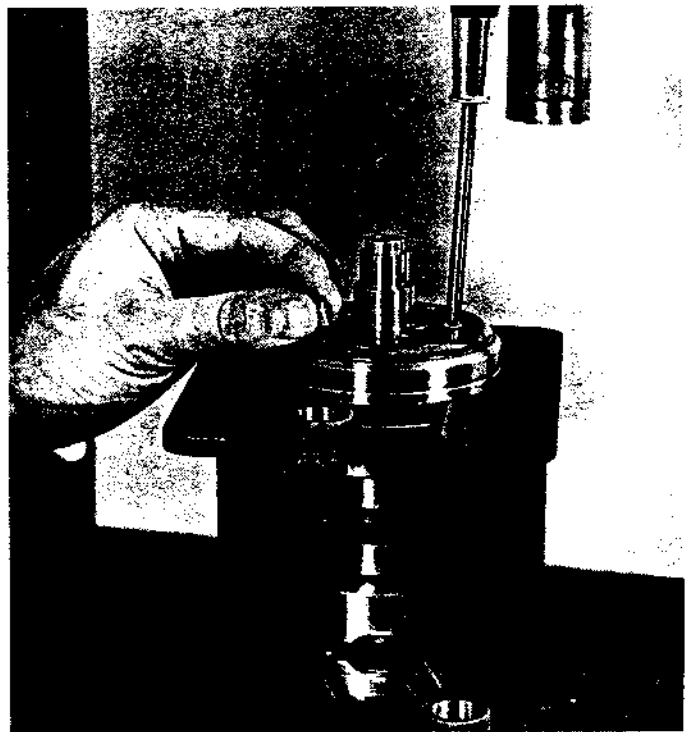
1

Remove the two (2) 4 X 12 mm dowel pins (rotary valve drive pins) if you have not done so before. Remove outside main bearing, place the proto bearing puller (tool N) so that the thin blade area of puller is in a position to close between bearing and flywheel. Hold crankshaft assembly with bearing puller in place and position as shown in photo. With a lead hammer, strike a sharp blow on the edge of the puller, this will loosen the bearing and seat the blades of the bearing puller between the main bearing and the flywheel. Thread the nuts of the bearing puller all the way down to secure both halves of the puller. Continue to press bearing off of the crankshaft.



2

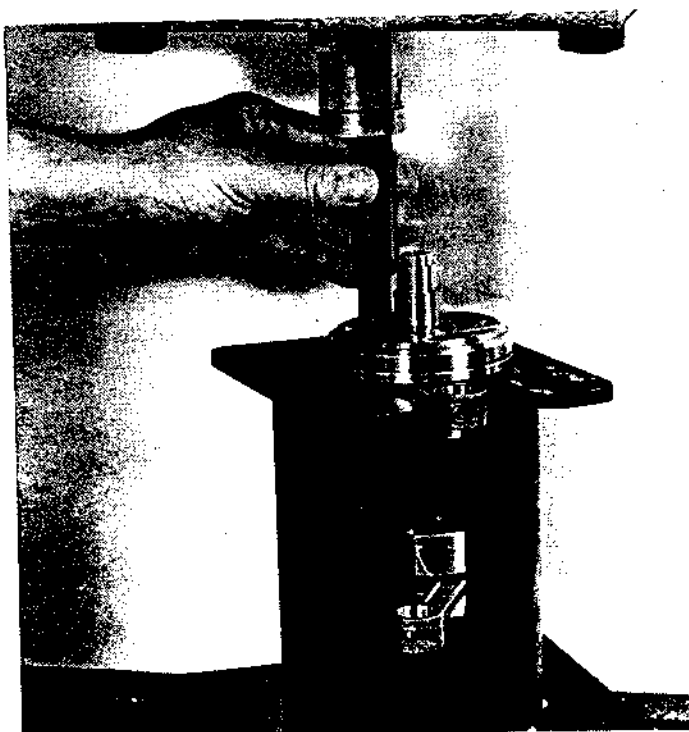
Place the flywheel support plate (tool S) between the left hand crankshaft and the crank web center. Position the support plate so that the big end of the connecting rod is at the closed end of the rod access slot in the support plate. Place crankshaft assembly, with support plate in position (make sure to position all rods to extend through rod access slot), into the crankshaft guide as shown.



3

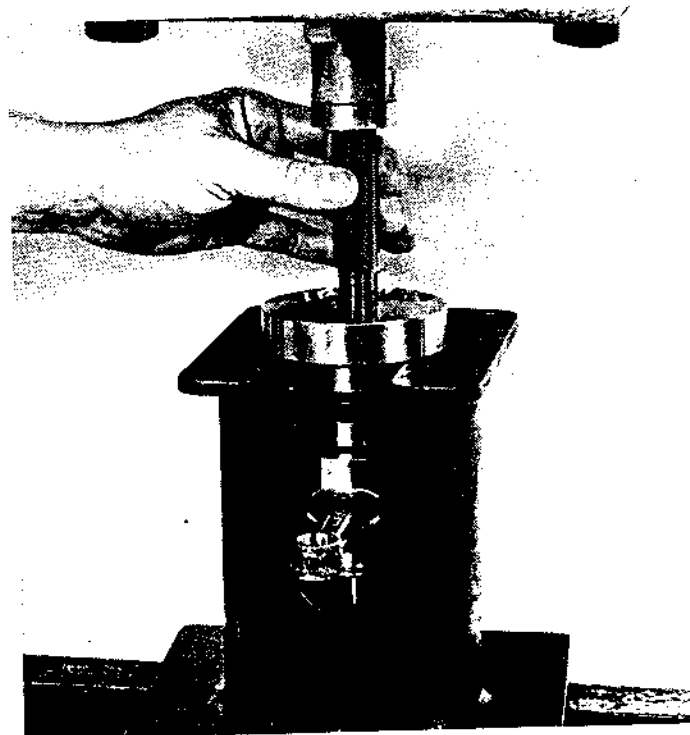
Remove four (4) Phillips screws from oil receiver. Use sharp bladed tool and pry oil receiver loose. NOTE: New oil receivers should be used if old units show any damage.

CAUTION: New Phillips screws **must** be used in the installation of the oil receiver. NOTE: Repeat procedure 1, 2, 3 for opposite end of crank assembly.



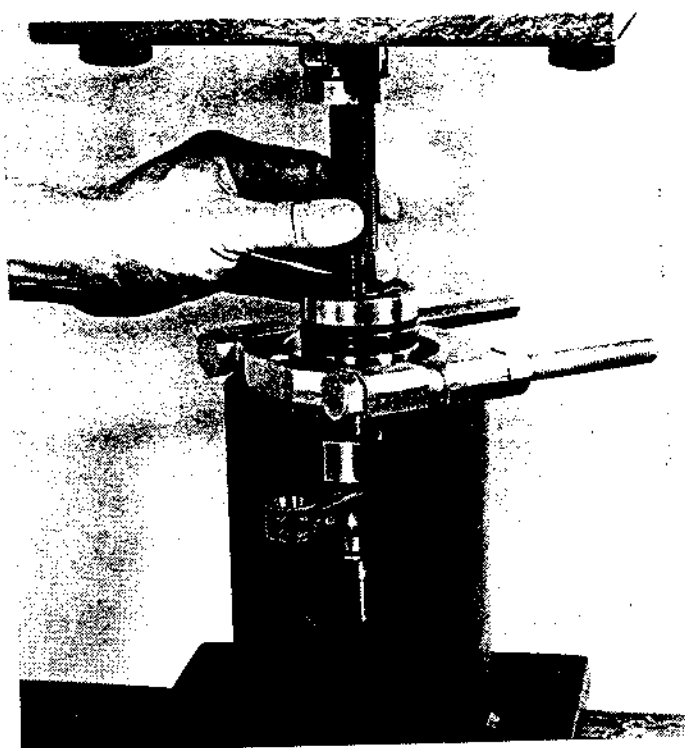
4

Place the press pin (tool K) in position on the crank pin and press left hand crank and center web apart.



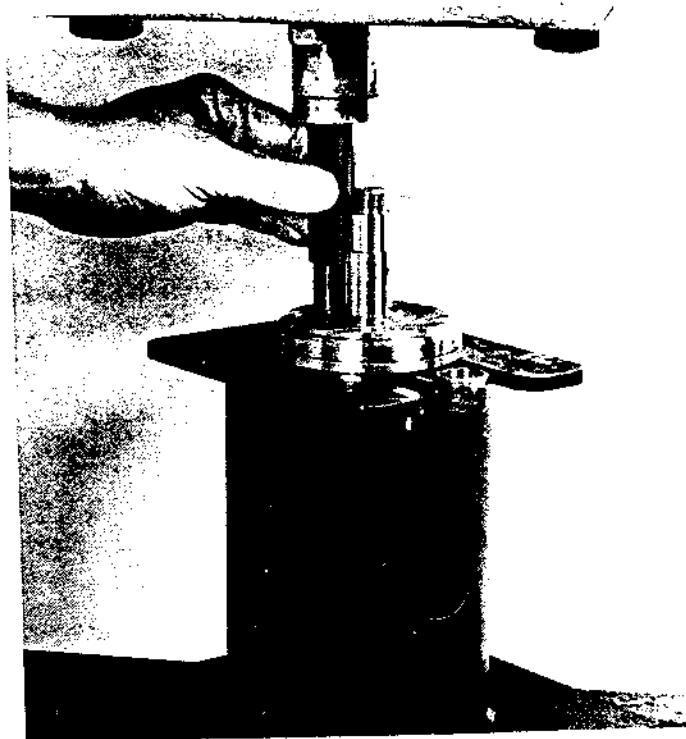
5

Position the flywheel support plate under the center web and press out the right hand crankshaft, center web and center bearings.



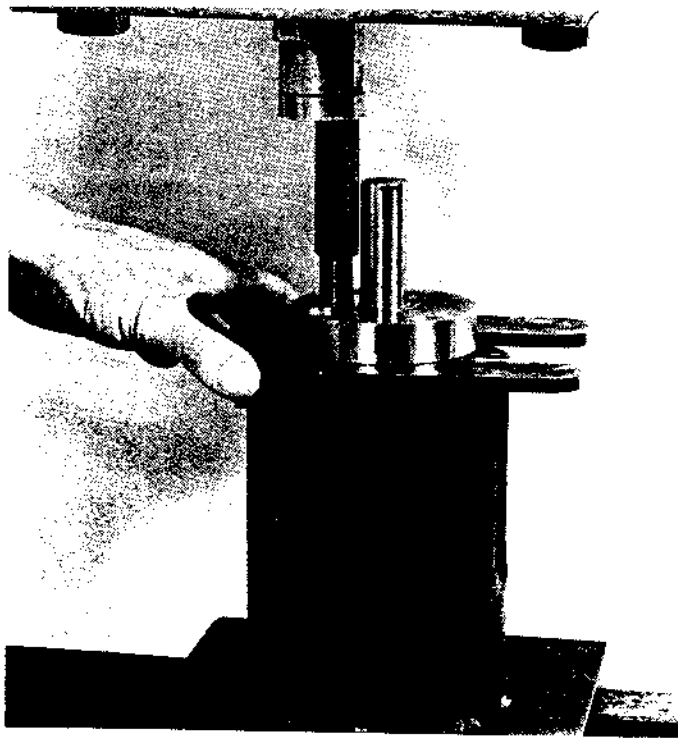
6

Follow the same bearing removal procedures as described previously and remove the center main bearings.



7

Position the flywheel support plate under the right hand crankshaft, and press out the center web with the press pin.



8

Place crankshafts (2) on the flywheel support plate and press out the crank pins. CAUTION: Be sure and keep rod and crank pins together. **Do not mix pin & rod sets.**

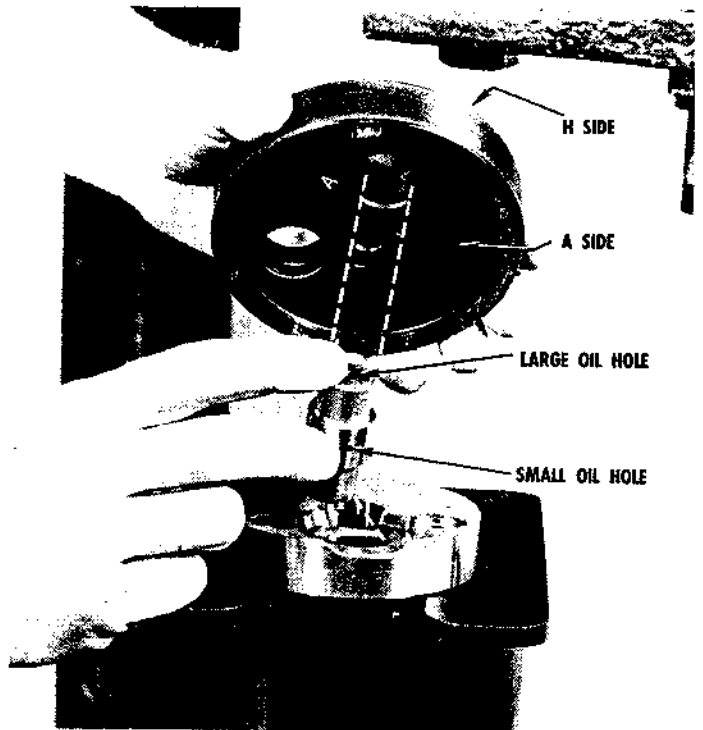


9

Remove locking pin from crank web center. NOTE: Carefully deburr the hole.

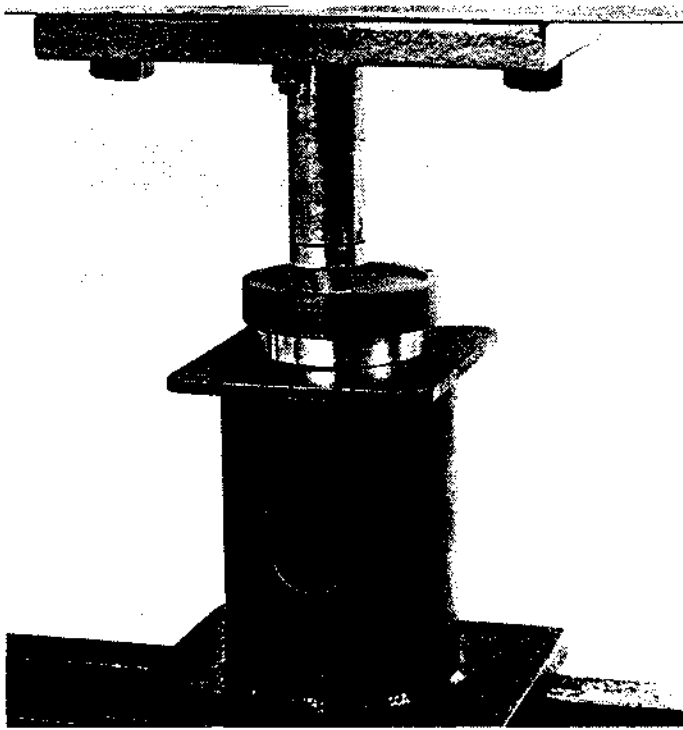
Degrease parts, examine for damage, obtain new parts required.

## 250S A1 350S A7 CRANKSHAFT ASSEMBLY



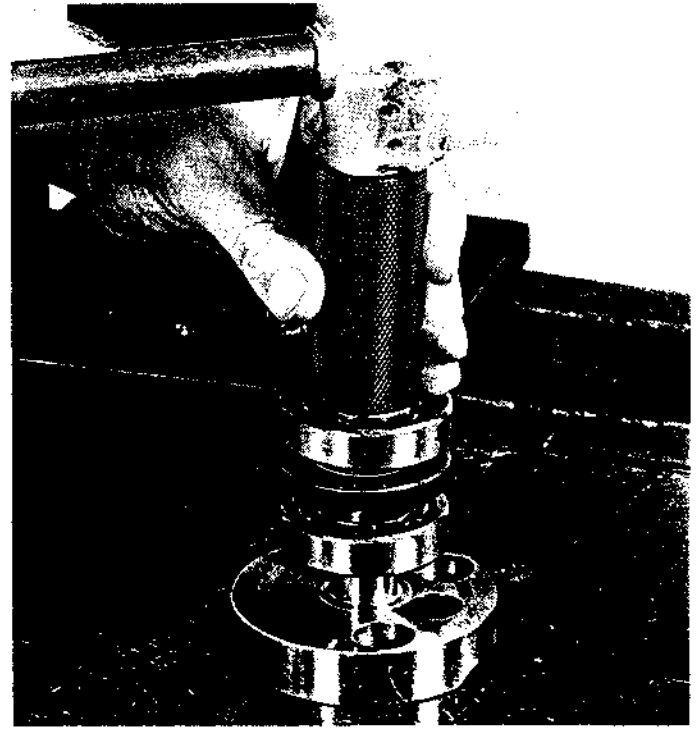
1

Place new rod pin (or old if to be used) in the upper indexing plate and crank pin guide (tool B) in position as indicated in photo. Large oil hole end up in the hole marked A. Small oil hole facing to outside of flywheel diameter on the centerline.



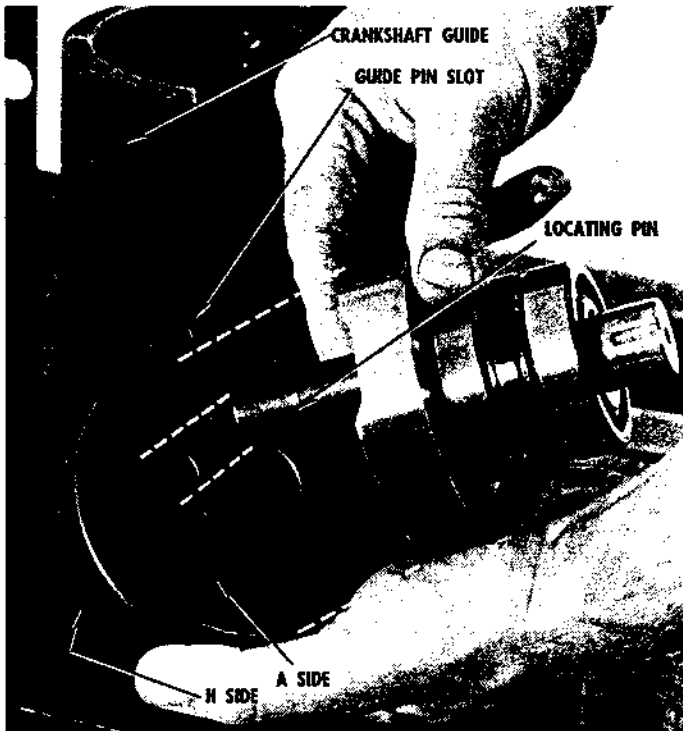
2

Following the above procedure for the right hand crankshaft and center crank web. Position on the flywheel support plate as shown in photo and press in. NOTE: Crank pin shoulder must bottom on surface of flywheel.



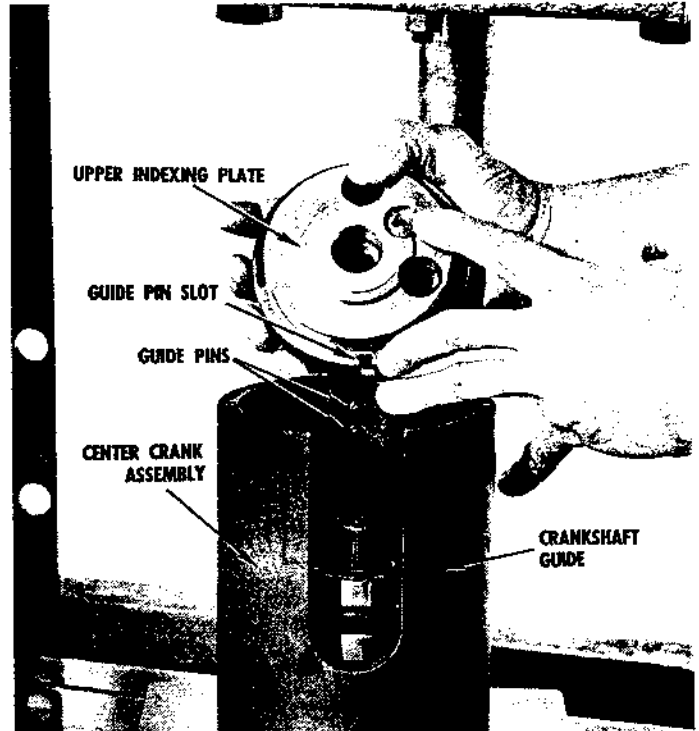
3

Install main bearings as shown, on the center crankshaft, using the main bearing installation tool (tool L).



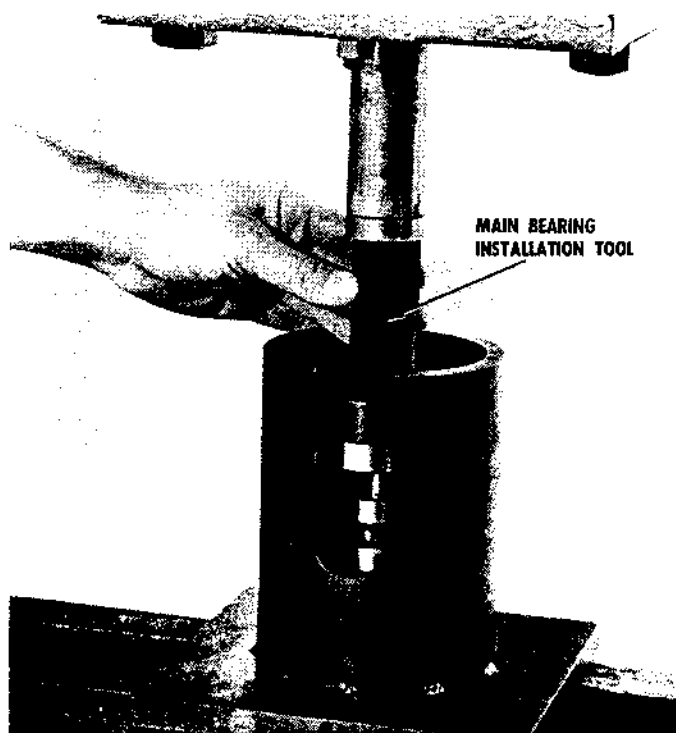
4

Position the lower indexing plate (tool F) "A" side up as shown. Position the locating pin (tool M) in the crank pin hole of the center crankshaft, place the opposite end of locating pin in the indexing plate, and the O.D. of the crankshaft wheel in the counterbore of the lower indexing plate. Position assembly in crankshaft guide.



5

Be sure that guide pin slot of lower indexing plate engages lower guide pin and that lower indexing plate sits flush on bottom of crankshaft guide. Place upper indexing plate on the center crank web so that O.D. of crankwheel fits the counterbore of the upper indexing plate (tool B) side "A", and the crank pin is in hole "A". Place in crankshaft guide, be sure upper guide pins engage upper indexing plate guide pin slot.



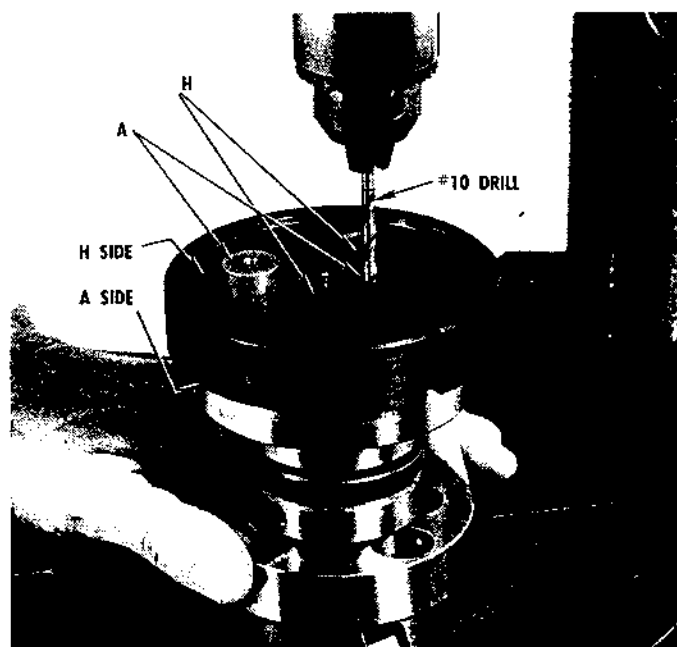
6

Place assembly stack in position on the hydraulic press, use the main bearing installation tool and press assembly together. NOTE: Crank web must bottom out on the inner races of main bearings. (Add slight pressure after bottoming to insure contact mating.)



8

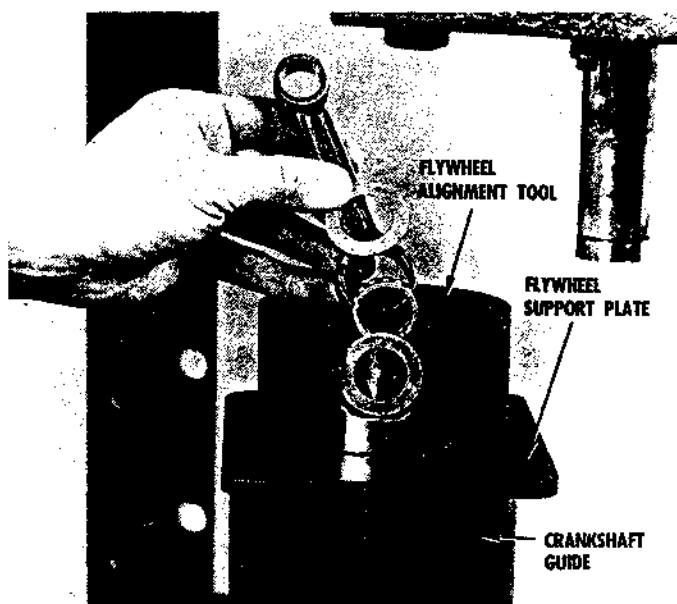
Install locking pins, start pin with a hammer and seat in the locking pin hole with a punch. NOTE: Stake locking pin in position.



7

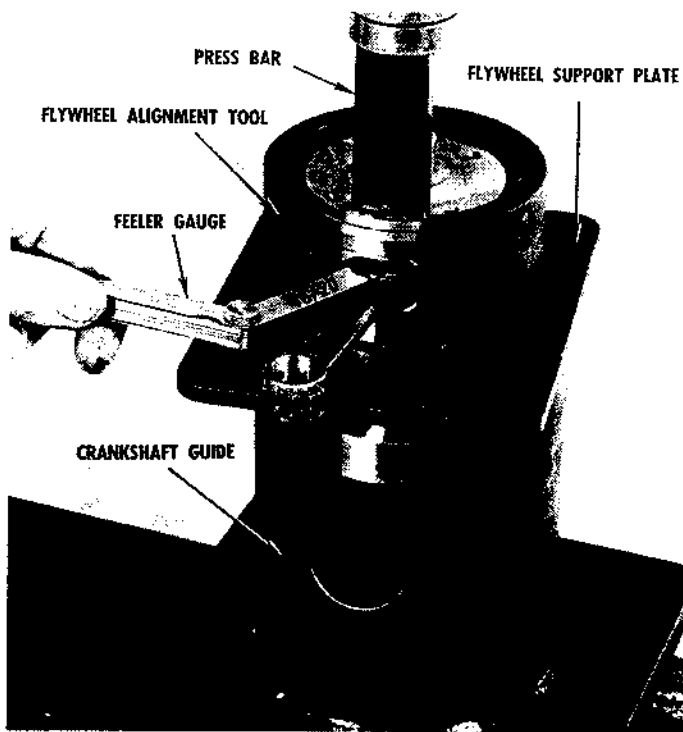
If new crank centers are used it will be necessary to drill the locking pin hole. The upper indexing plate and crank pin guide (tool B), also serves the purpose of a drill jig to locate and drill the locking pin hole. NOTE: When new, the jig holes are not full size. The first time the jig is used care must be taken to insure a smooth drilling operation. NOTE: Drill size is a #10. NOTE: Do not attempt to drill already drilled cranks. Drill to a depth of 13 mm (.562 in.)

The drill jig hole for the H1 locking pin hole is located on the center line of the crank pin hole — opposite the H1 crank pin hole. See Photo. NOTE: Not a locating hole, locking only.



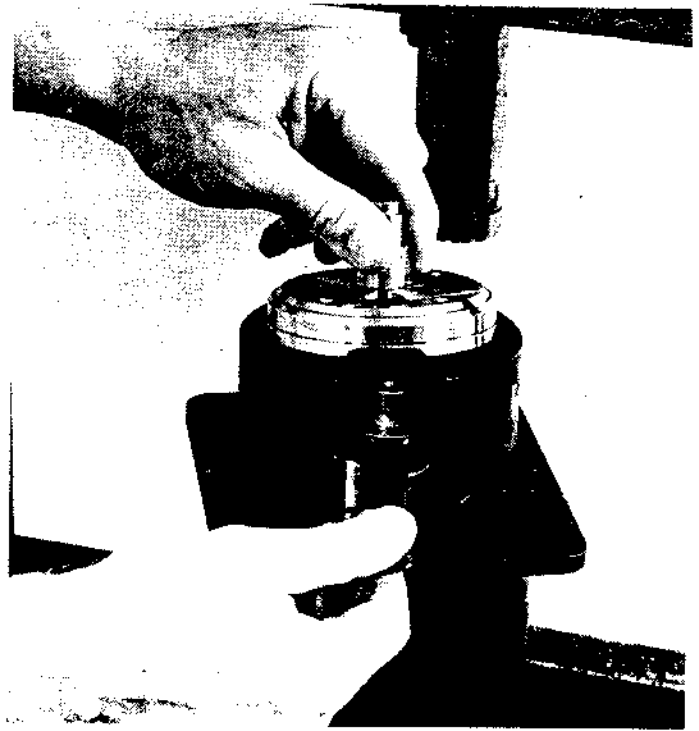
9

Place the flywheel support plate (tool S) under the center crank, and position in the crankshaft guide. Place the flywheel alignment tool (tool H) over the center crank, with the connecting rod access slot at the crank pin position. NOTE: Apply Lubriplate to all con rod assemblies. Install thrust washer, big end bearing, rod and thrust washer on crank pin. Place center web in position in flywheel alignment tool.



10

Place (tool BB) press bar over crank pin hole, and place feeler gauge in position to establish big end side clearance, 0.40-0.50 mm (0.016-0.020 in.) for 250S A1-350S A7. Press together.



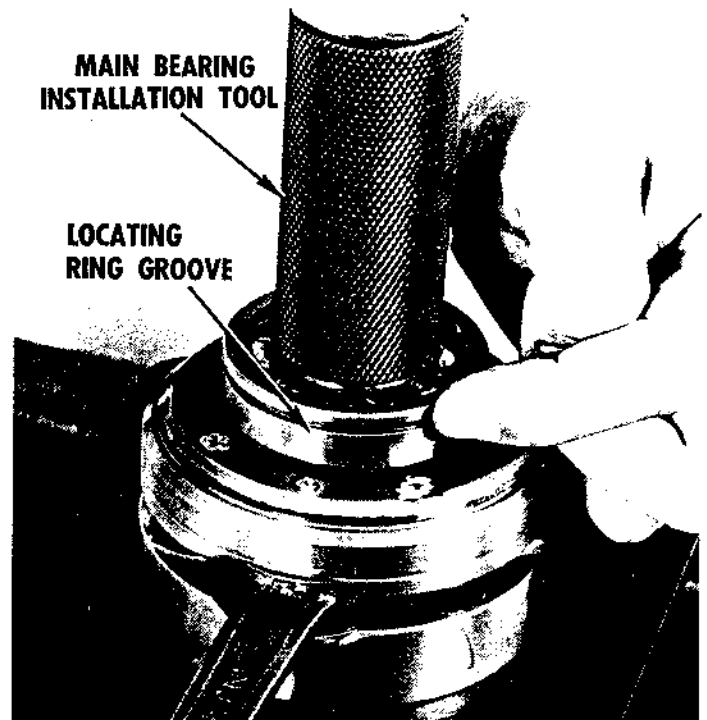
11

Reposition crank assembly and install the left hand rod assembly and left hand crankshaft.



12

Install the oil receivers on both ends of the crank assembly. NOTE: Use new Phillips head screws. Use Loc-tite on all screws. CAUTION: Be sure and stake all screw heads to safety lock.



13

Install outer main bearings on each end of the crankshaft assembly with the main bearing installation tool. CAUTION: Make sure the right hand main bearing is installed with locating ring groove to the outside of the crankshaft assembly. As shown in photo.



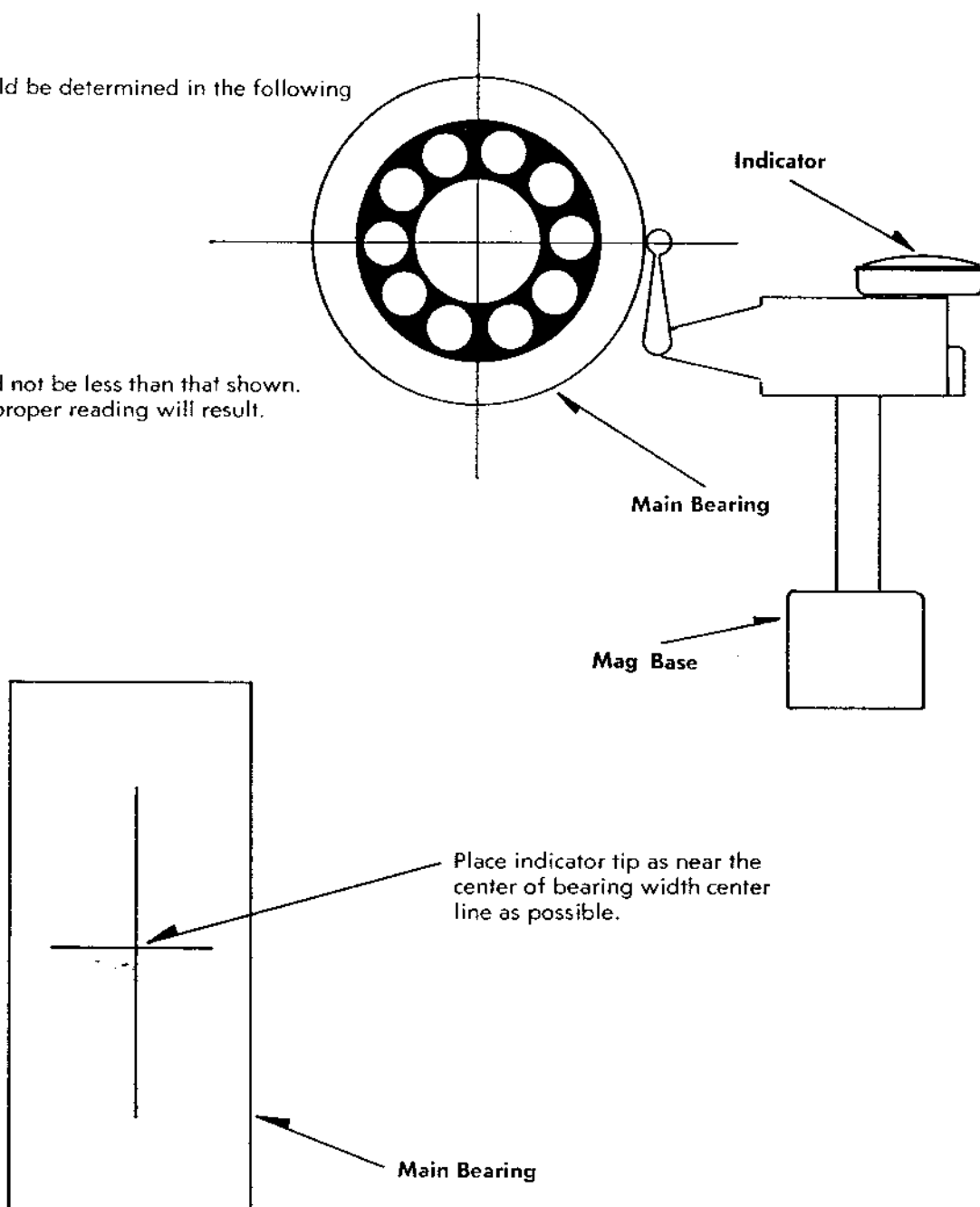
## 250S A1, 350S A7 CRANKSHAFT

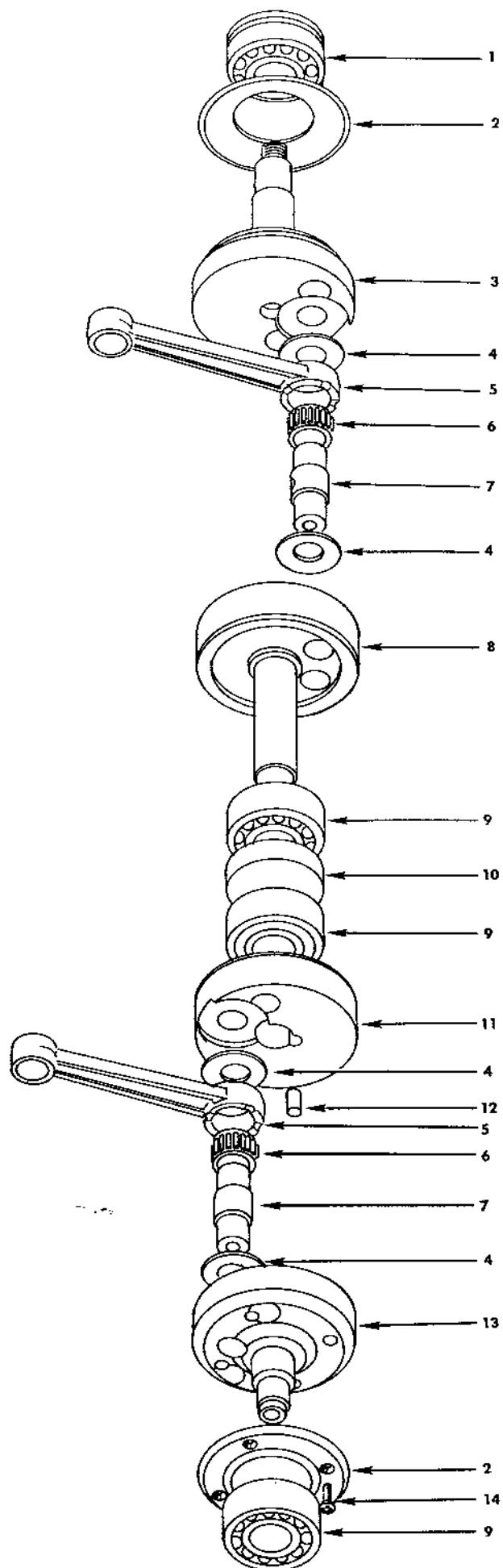
CLEARANCE TABLE

BIG END SIDE CLEARANCE	BIG END RADIAL CLEARANCE	RUNOUT OF CRANKSHAFT
0.016 – 0.020 in.	0.00016 – 0.00047 in.	0.0008 in. (0.02 mm)
(0.40 – 0.50 mm)	(0.004 – 0.012 mm)	Max. 0.0024 in. (0.06 mm)

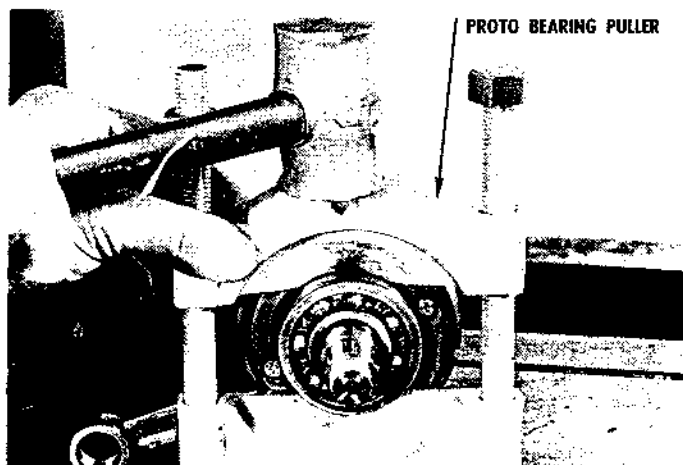
\*Crankshaft runout should be determined in the following manner:

Angle of indicator should not be less than that shown. If angle is not proper improper reading will result.





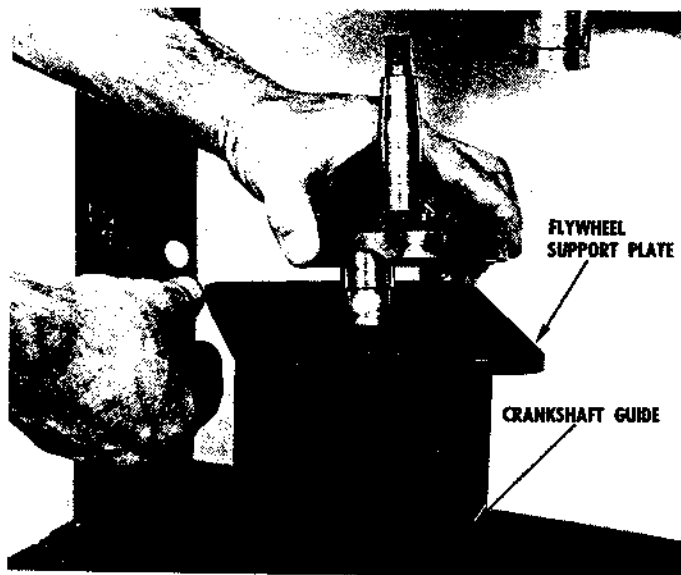
## 350E F5 CRANKSHAFT TOOLS & DISASSEMBLY



1

Using the proto bearing puller (tool N), remove the left hand main bearing. Place puller so that the thin blade area of puller is in a position to close between bearing and flywheel. Hold crankshaft assembly with bearing puller in place and position as shown in photo. With a lead hammer, strike a sharp blow on the edge of the bearing puller, this will loosen bearing and seat the blades of the bearing puller between the main bearing and the flywheel. Thread the nuts of the bearing puller all the way down to secure both halves of puller. Continue to press bearing off of the crankshaft. Remove three (3) Phillips screws from oil receiver. Use a blade-type tool and remove oil receiver.

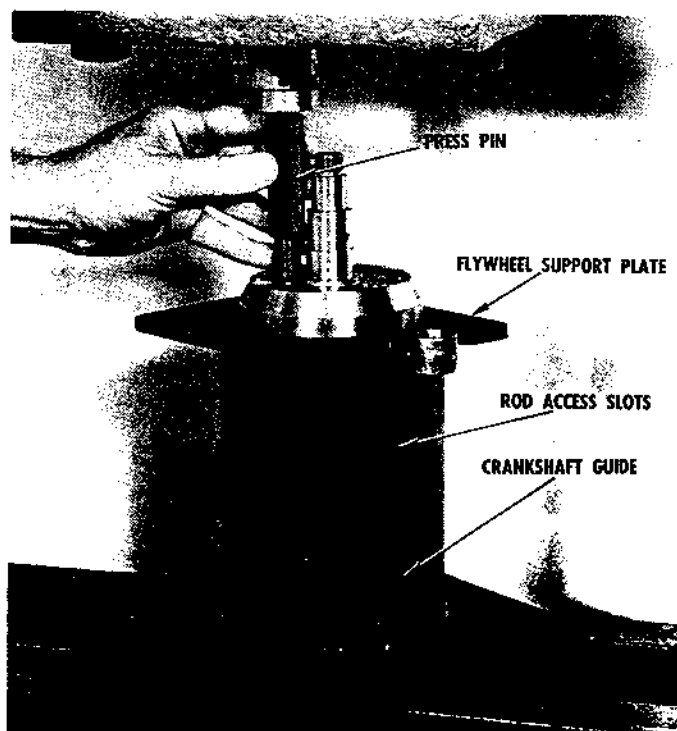
**CAUTION:** Before going on with the crankshaft disassembly, be sure to move the upper and lower crankshaft guide (tool D) guide pins to a position flush with the I.D. of the crankshaft guide (tool D).



3

Position flywheel support plate (tool S) under the right hand crankshaft, with the big end of the rod at the closed end of the flywheel, and small end of rod in position in access slot of flywheel support plate. Place crank assembly and support plate in position on the crankshaft guide (tool D) as shown. Position assembly stack in place on the hydraulic press, and use the press pin (tool K) to press the crankshaft apart.

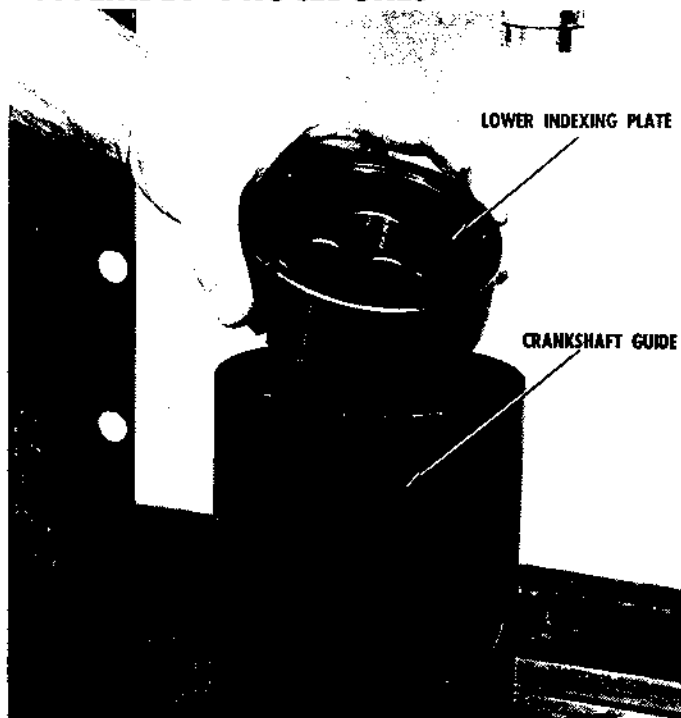
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2

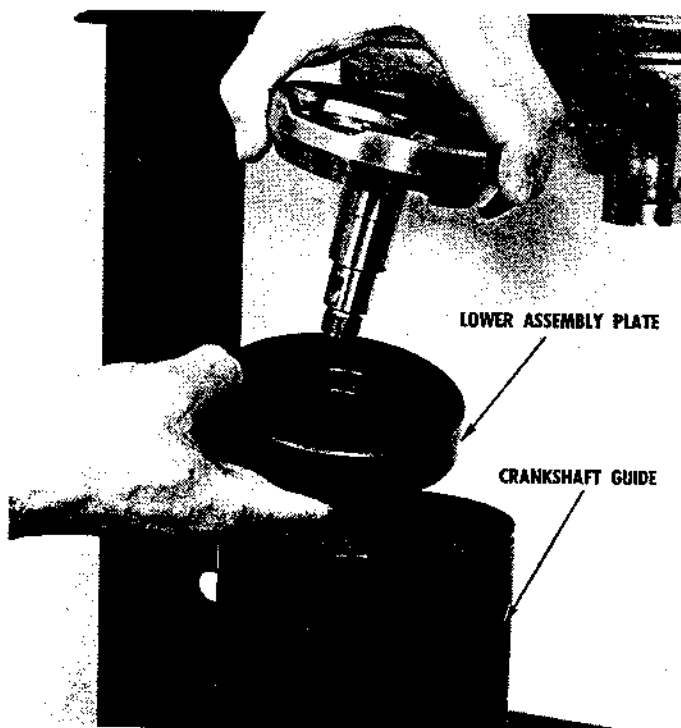
Remove rod assembly and right hand crankshaft from crankshaft guide, place right hand crankshaft and rod assembly in parts basket. Position left hand crankshaft on the flywheel support plate and press out the crank pin.

## 350E F5 ASSEMBLY PROCEDURES



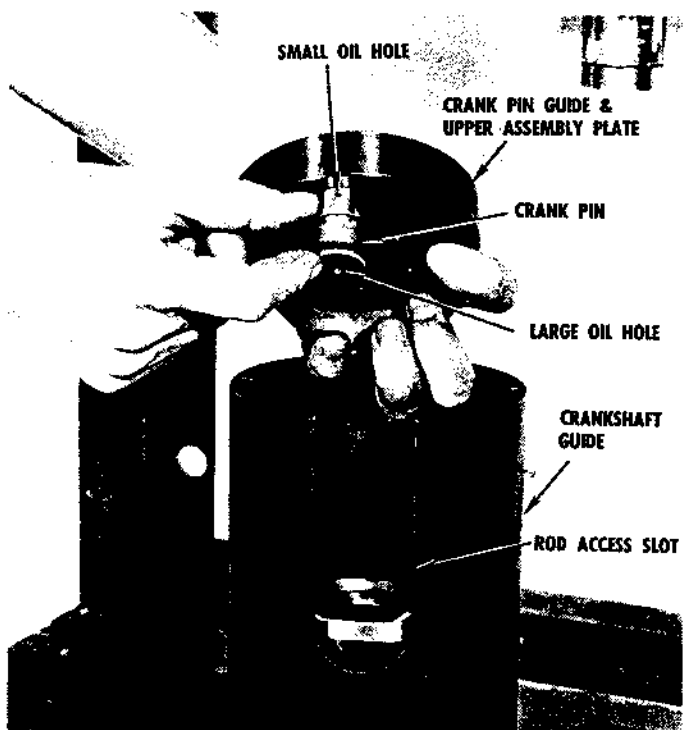
1

Place the lower indexing plate (tool F) in the bottom of the crankshaft guide (tool D). NOTE: This tool (tool F) acts as a spacer only.



2

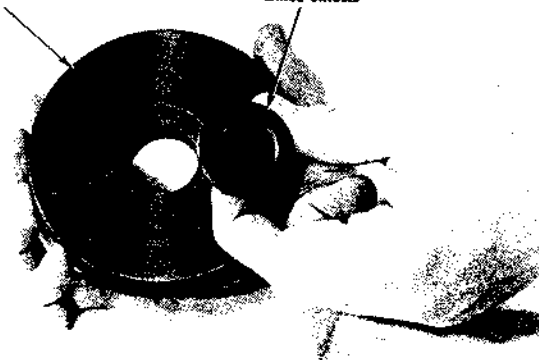
Using the lower assembly plate (tool C) place the right hand crankshaft in position with the shaft through the center of the lower assembly plate. Lower into crankshaft guide (tool D) so that shaft passes through the spacer and is sitting flush on the bottom. Be sure to have crank pin hole in alignment with the rod access slot.



4

Position the crank pin in the crank pin guide and upper assembly plate (tool G), such that the large oil hole end is pressed into the right hand crankshaft pointing toward the oil receiver. The small oil hole faces outward from the center of the crankshaft, on the centerline.

LOWER ASSEMBLY PLATE  
BUSHING LOWER ASSEMBLY PLATE - LARGE SINGLES



3

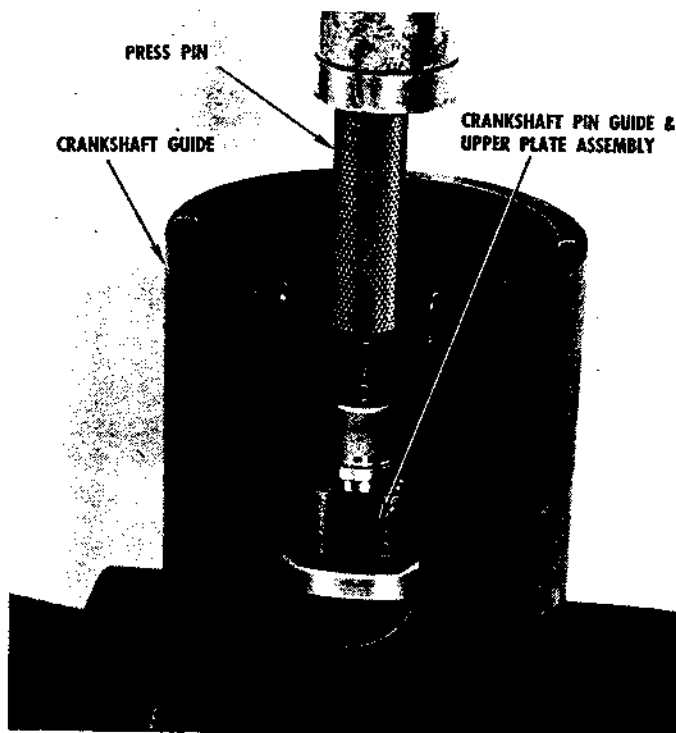
The lower assembly plate (tool C) is used for the assembly of all single cylinder models. The center hole is the correct size when the lower assembly plate is used to assemble the 250E F8 and the 350E F5. Bushing in photo is used for assembly of the following singles:

125E F6	175E F7	175 F3
238 F21M	250 F4	175 F2

Bushing-lower assembly plate-small singles (tool V), is used for the assembly of the following single models:

90S G3	100T G3TR	100E G4TR
100C G31M	120 C2TR	

The bushings (tools U & V), are used to reduce the I.D. of the center hole of lower assembly plate (tool C) to fit the crankshaft being rebuilt.

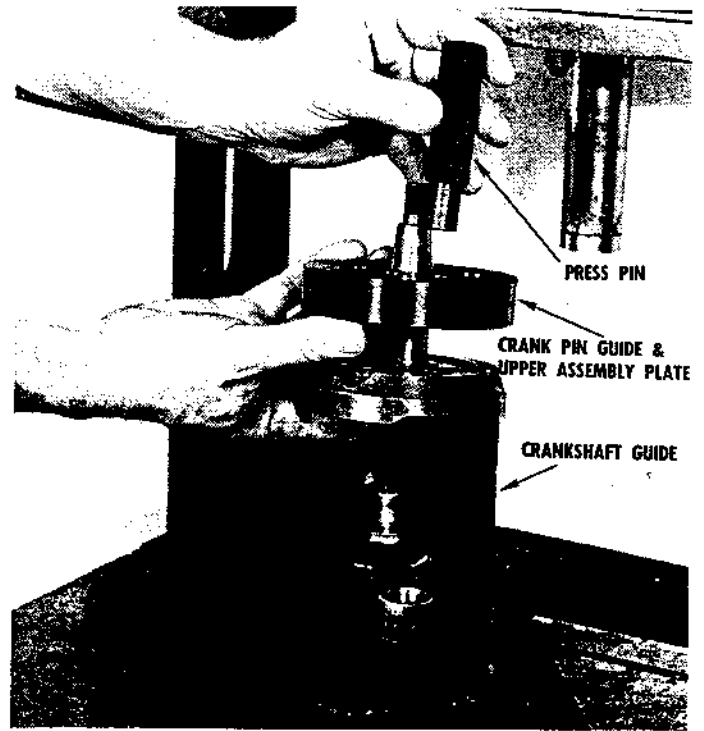


5

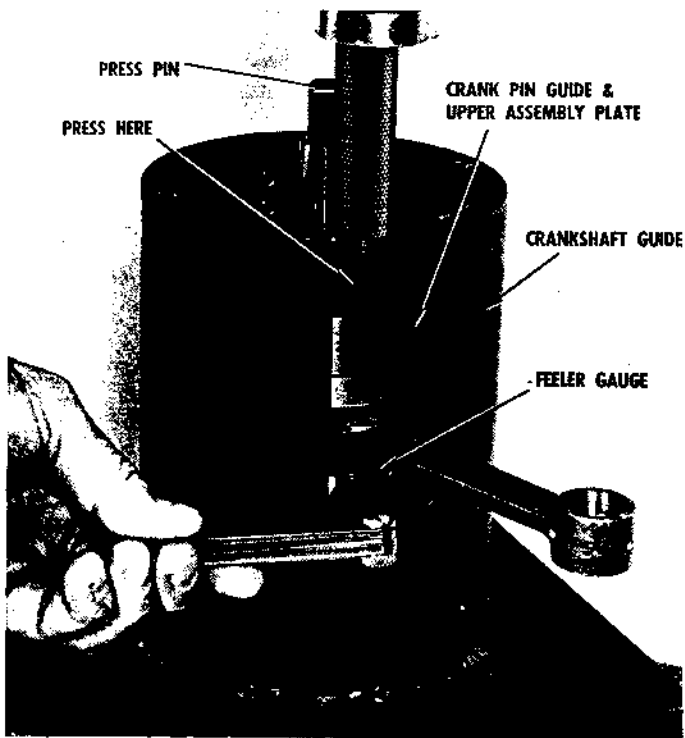
Position the crank pin guide and the crank pin in the crankshaft guide. Place assembly stack in the hydraulic press. Place the press pin (tool K) in position and press in the crank pin. NOTE: The shoulder of the crank pin must bottom on the face of the flywheel.



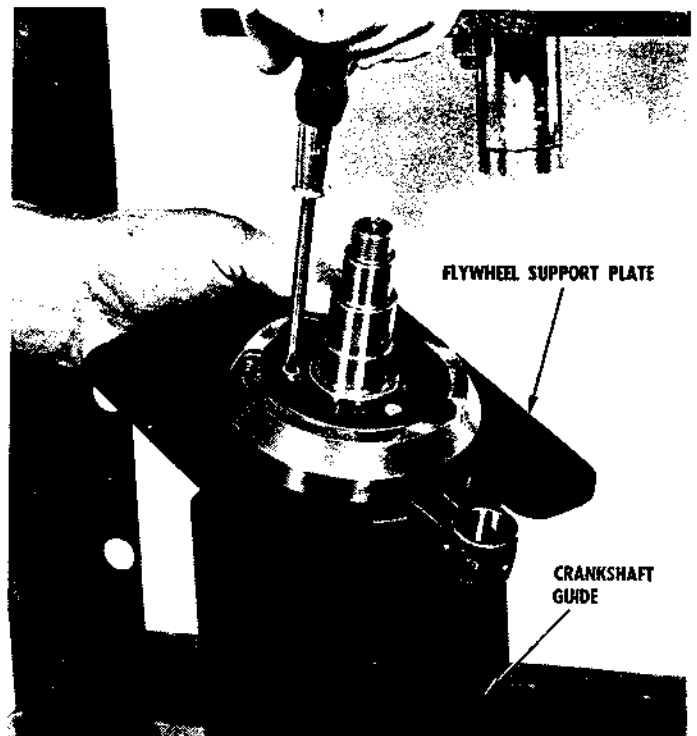
**6**  
Install new connecting rod assembly, thrust washer—big end bearing—con rod—thrust washer. As shown. NOTE: Pack big end bearing with a suitable hi-temp grease.



**7**  
Place the left hand crankshaft in the upper assembly plate (tool G) as shown. Position the left hand crankshaft and upper assembly plate in the crankshaft guide, with crank pin hole in position over the crank pin.

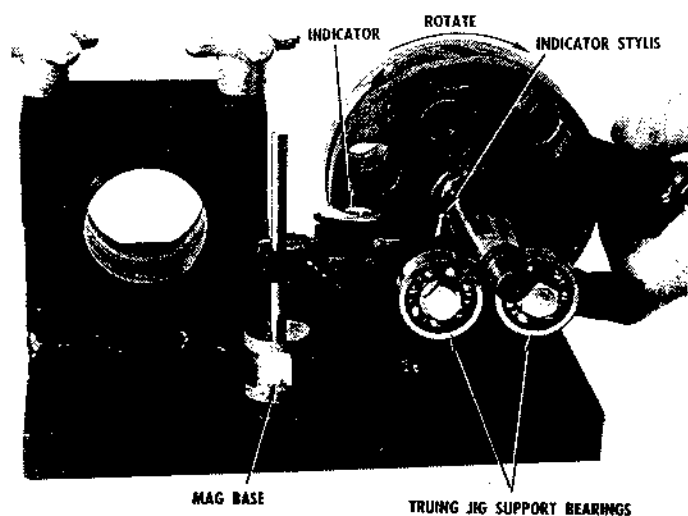


**8**  
Place assembly stack in hydraulic press. Position press pin so that pressure is applied to upper surface of upper assembly plate (as shown). Use a feeler gauge to establish the big end clearance (0.38 mm—0.48 mm) — (0.015 in—0.019 in). Press assembly together.



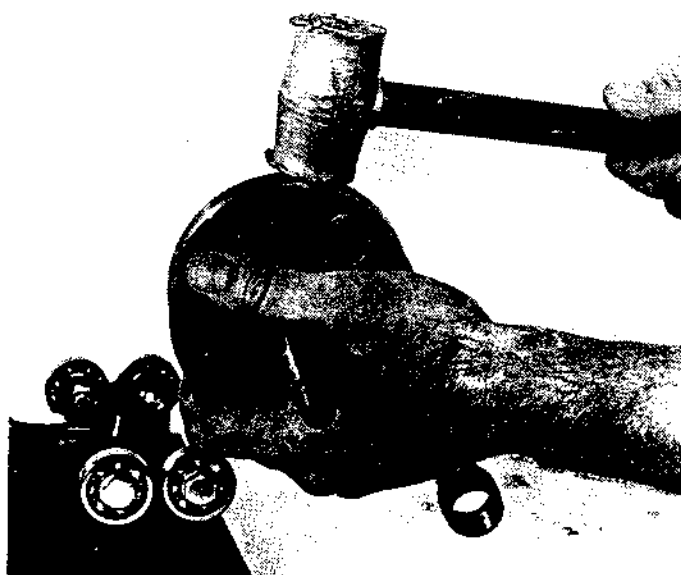
**9**  
Install the oil receiver with three (3) Phillips head screws. CAUTION: Use only new screws. Screws must be installed with Loc-tite, and all screws must be safety staked.

## 350E F5 TRUING PROCEDURES



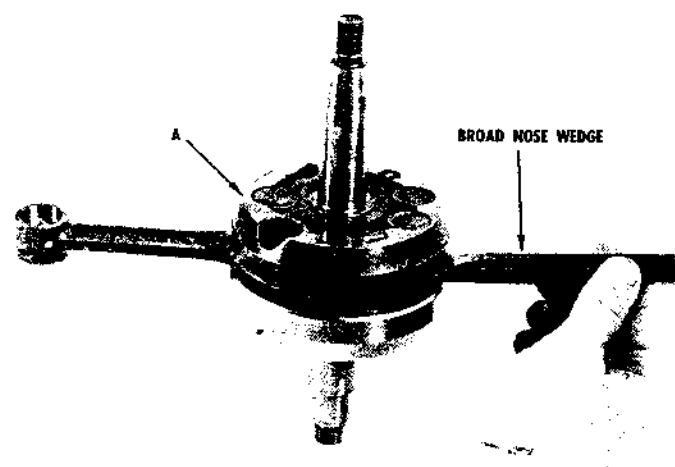
1

Place crankshaft assembly on the support bearing of the truing jig. Position indicator stylus as shown. Achieve a zero reading on the indicator dial that is midway within its range. Rotate crank (in direction of arrow) to determine if assembly is true or if adjustment is required to correct an out-of-tolerance runout condition.



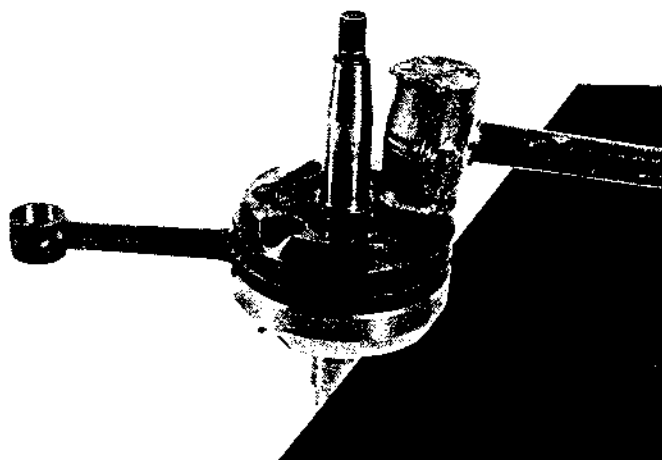
2

To adjust crankshaft for an out-of-tolerance runout condition, apply adjustment pressure with lead hammer on the crank as shown in the photo. NOTE: The use of the truing jig support bearings in truing procedures for the smaller singles, will necessitate the moving of the support bearings to the inside of the mounting towers.



3

When during the truing procedure, it is determined that a crankshaft assembly has an open or closed condition of the crank halves, as indicated in the photos, it will be necessary to adjust accordingly. When a closed condition exists, adjustment must be accomplished by inserting a suitable broad nosed wedge between the crankshaft halves (as in photo). CAUTION: Do not attempt adjustment of a closed condition by applying pressure to the "A" section. If adjustment pressure is applied to the "A" section **decreased big end side clearance** will result.



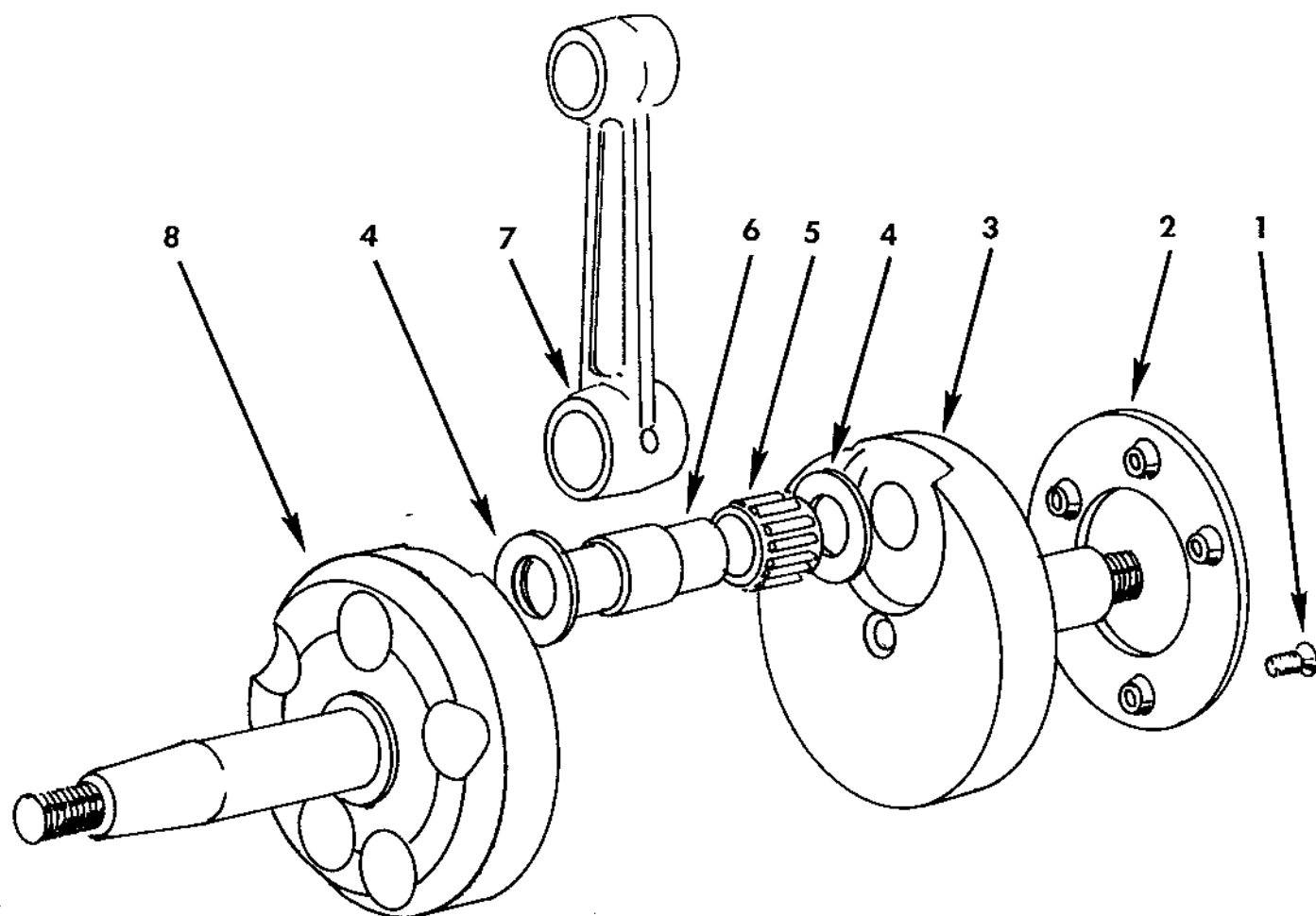
4

If an open condition exists such as depicted in the photo, place one crank half on a solid surface (block of aluminum—solid table top), and apply adjustment pressure as indicated.

Recheck adjusted crankshaft in the same manner followed in the truing procedures.

## 350E F5&F5A CRANKSHAFT PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	QUANTITY		
			F5	F5A	
1	92012-002	Screw—Countersunk	3	3	
2	13045-006	Oil Holder—Crankshaft	1	1	
3	13038-031	R. H. Crankshaft		1	
	13038-041	R. H. Crankshaft (white painted)	1		E/No. 7269
4-7	13044-009	Connecting Rod Set		1	
	13044-017	Connecting Rod Set	1		E/No. 7269
4	92026-065	Washer—Connecting Rod Side LT = 1 m/m		2	
	92026-069	Washer—Connecting Rod Side LT = 2 m/m	2		E/No. 7269
5	13034-020	Needle Bearing—Big End	1	1	
6	13035-021	Crank Pin — L = 20 m/m		1	
	13035-026	Crank Pin — L = 22 m/m	1		E/No. 7269
8	13037-035	L. H. Crankshaft		1	
	13037-045	L. H. Crankshaft (white painted)	1		E/No. 7269



# **ALL MODEL TABLE** **BIG END SIDE CLEARANCE**

NO.	MM	INCHES	WEAR LIMIT
G3SS-90S	0.35-0.45	0.014-0.018	0.60 mm—(0.024 in)
G3TR-100T	0.35-0.45	0.014-0.018	0.60 mm—(0.024 in)
G31M-100C	0.35-0.45	0.014-0.018	0.60 mm—(0.024 in)
G4TR-100E	0.35-0.45	0.014-0.018	0.60 mm—(0.024 in)
125E-F6	0.35-0.40	0.014-0.016	0.60 mm—(0.024 in)
175E-F7	0.35-0.40	0.014-0.016	0.60 mm—(0.024 in)
350E-F5	0.38-0.48	0.015-0.019	0.60 mm—(0.024 in)
250E-F8	0.38-0.48	0.015-0.019	0.60 mm—(0.024 in)
250C-F81M	0.38-0.48	0.015-0.019	0.60 mm—(0.024 in)
250S-A1	0.40-0.50	0.016-0.020	0.60 mm—(0.024 in)
350S-A7	0.40-0.50	0.016-0.020	0.60 mm—(0.024 in)
500S-H1	0.40-0.55	0.016-0.022	0.60 mm—(0.024 in)



# CRANKSHAFT COMPONENTS QUICK REFERENCE CHART

Model	Crank Assy	R. H. Crank Bearing	L. H. Crank Bearing	Conn Rod Assy	Big End Bearing	Crank Pin	Thrust Washer	L. H. Crank	R. H. Crank
A1	13036-015	92045-002	601B6305	13044-006	N/A	N/A	92026-024	13037-022	13038-016
A7	13036-021	92045-002	601B6305	13044-007	N/A	N/A	92026-024	13037-031	13038-027
C2	13036-010	601B6304	601B6304	13044-003	13034-006	13035-006	92026-011	13037-016	13038-010
F2	13036-014	601B6305	601B6305	13044-004	13034-010	13035-005	92026-024	13037-021	13038-015
F21M	13036-017	601B6305	601B6305	13044-005	13034-012	13035-012	92026-030	13037-025	13038-019
F3	13031-027	601B6305	601B6305	13044-004	13034-010	13035-005	92026-024	13037-021	13038-015
F4	13036-017	601B6305	601B6305	13044-005	13034-012	13035-012	92026-030	13037-025	13038-019
F5	13036-023	92045-016	601B6305	13044-009	13034-020	13035-021	92026-065	13037-035	13038-031
F5A	13036-032	92045-016	601B6305	13044-017	13034-020	13035-026	92026-069	13037-045	13038-041
F6	13036-028	601B6205	601B6305	13044-012	13034-021	13035-022	92026-011	13037-040	13038-034
F7	13036-027	601B6205	601B6305	13044-012	13034-021	13035-022	92026-011	13037-038	13038-034
F8	13036-023	92045-016	601B6305	13044-009	13034-020	13035-021	92026-065	13037-035	13038-031
F81M	13036-032	92045-016	601B6305	13044-017	PK293817.8X 13034-020	L=20m/m 13035-026	t=1m/m 92026-069	13037-045 white paint 13037-041	13038-041 white paint 13038-038
F81M	13036-029	92045-016	601B6305	13044-016	13034-020	13035-026	t=2m/m 92026-069	13037-045 white paint 13037-041	13038-041 white paint 13038-038
G3SS/TR	13036-011	601B6204	601B6204	13044-002	13034-007	13035-008	92025-005	13037-018	13038-012
G3-A	13036-031	601B6204	601B6204	13044-013	13034-023	13035-025	92025-047	13037-044	13038-040
G31M	13036-022	601B6204	601B6204	13044-008	13034-018	13035-008	92025-005	13037-018	13038-012
G31M-A	13036-031	601B6204	601B6204	13044-013	13034-023	13035-025	92025-047	13037-044	13038-040
G4TR	13036-011	601B6204	601B6204	13044-002	13034-007	13035-008	92025-005	13037-018	13038-012
G4TR-A	13036-031	601B6204	601B6204	13044-013	13034-023	13035-025	92025-047	13037-044	13038-040
MT1	13036-030	601B6204	601B6303	13044-015	13034-002	13035-024	92026-002	13037-043	13038-039

NOTE: Additional component parts for the A-series crankshaft are:

Center Brg.	Crank Oil seal collar	Center crank web	Center crank	Center bearing	Crank oil seal
601B6305	92027-031	13040-001	13039-001	601B6305	92056-001

Additional common component part for the F5, F5-A, F8, is the Oil Holder, crankshaft, P/N 13045-006

# INTRODUCTION

The steps to disassembly of the S1, S2, H2 crankshafts are the same as the H1 disassembly. The steps in rebuilding the S1, S2, H2 crankshafts are the same as that in the H1 manual except for three changes:

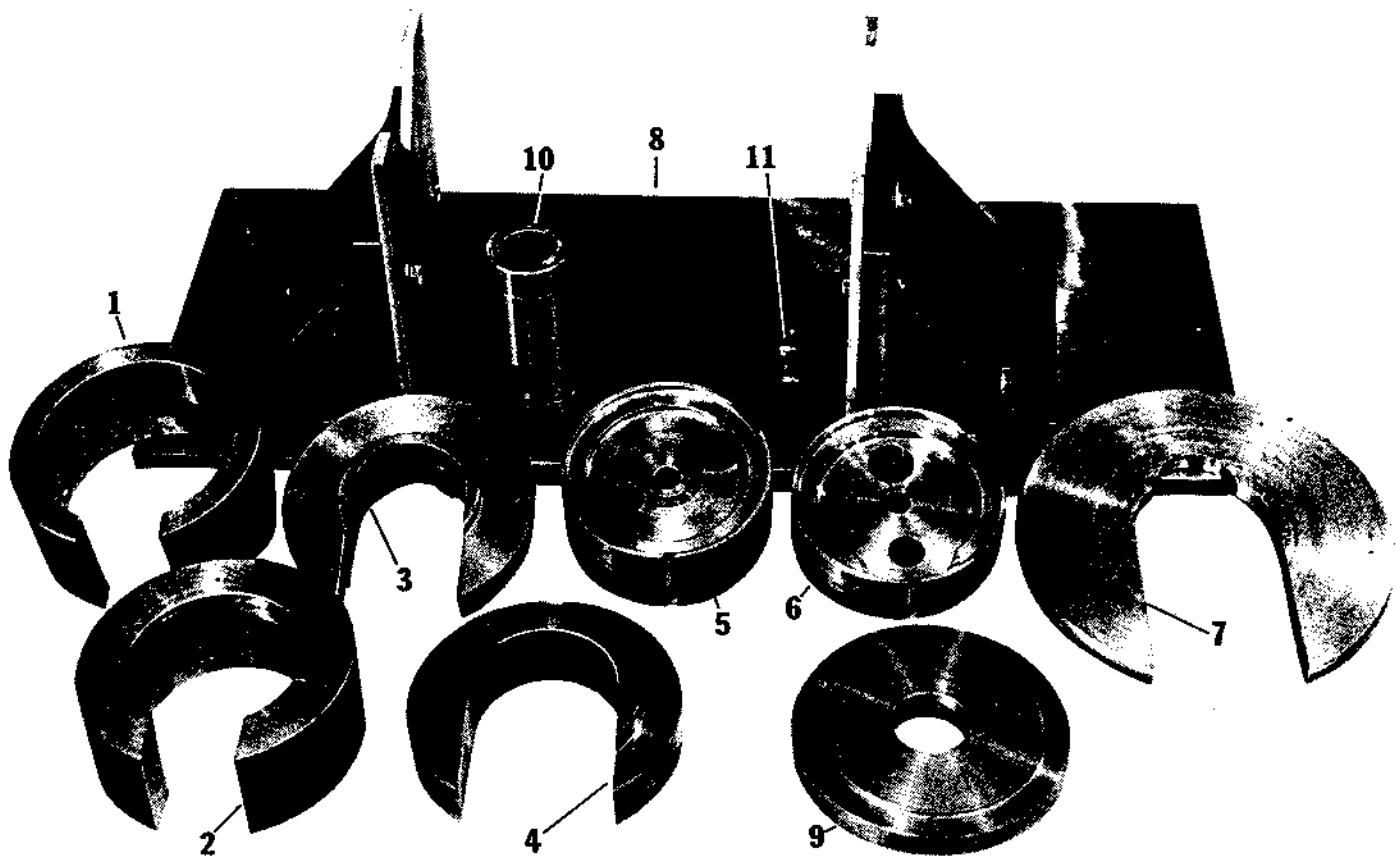
1. Steps 4 through 9 are the same except that the main bearing axle is pressed down into the outboard cylinder crank half instead of being put into the bottom of the pot.
2. The center cylinder is put together last through the use of the new pusher plate that allows you to push directly on the center flywheels.
3. Truing of the crank is done by supporting the crank on its two outboard main bearings instead of the inboard main bearings.

This is the prescribed manner in which KHI feels is the most accurate means of checking the crank.

NOTE: All the specifications, procedures, part numbers and prices subject to change without notice.

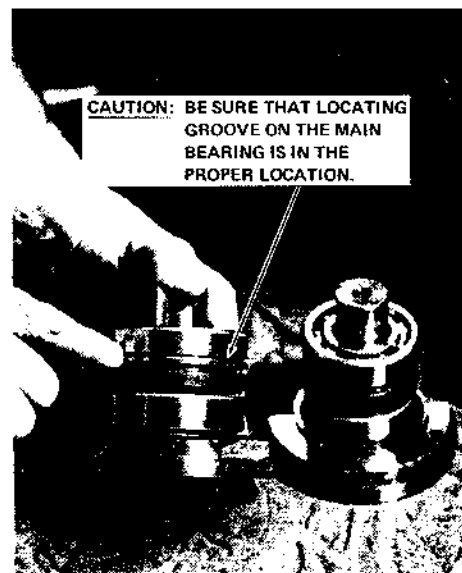
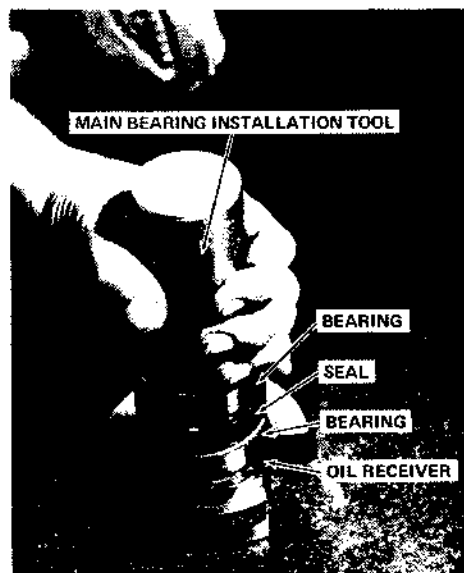
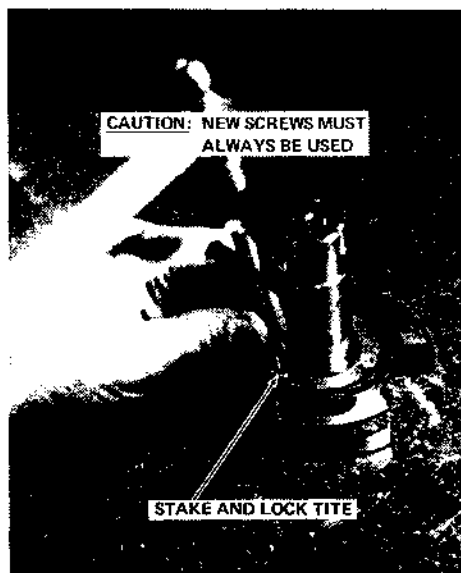
# UPDATE KIT PARTS LIST

- 1 H2 Assembly Pot
- 2 S1, S2 Assembly Pot
- 3 S1, S2 Center Pusher Plate
- 4 H2 Center Pusher Plate
- 5 Upper Index Jig
- 6 Lower Index Jig
- 7 H2 Support Plate
- 8 Truing Stand
- 9 Pot Pusher
- 10 H2 Bearing Pusher
- 11 Index Pin

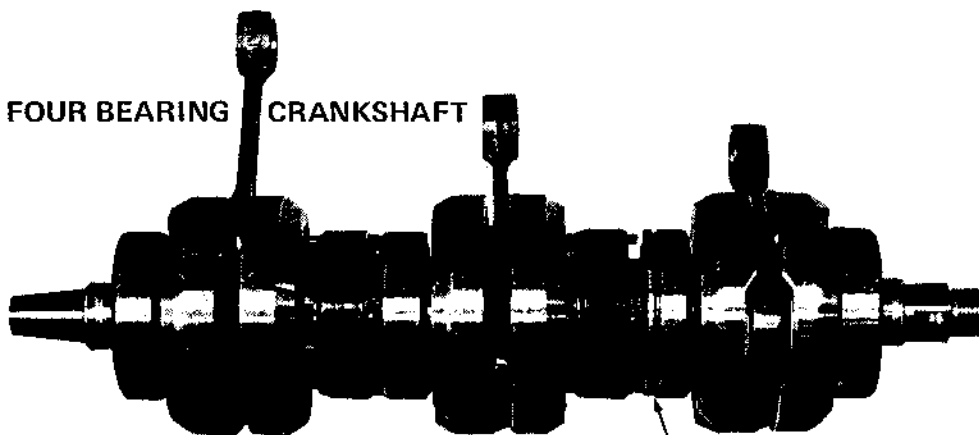


## STEP I:

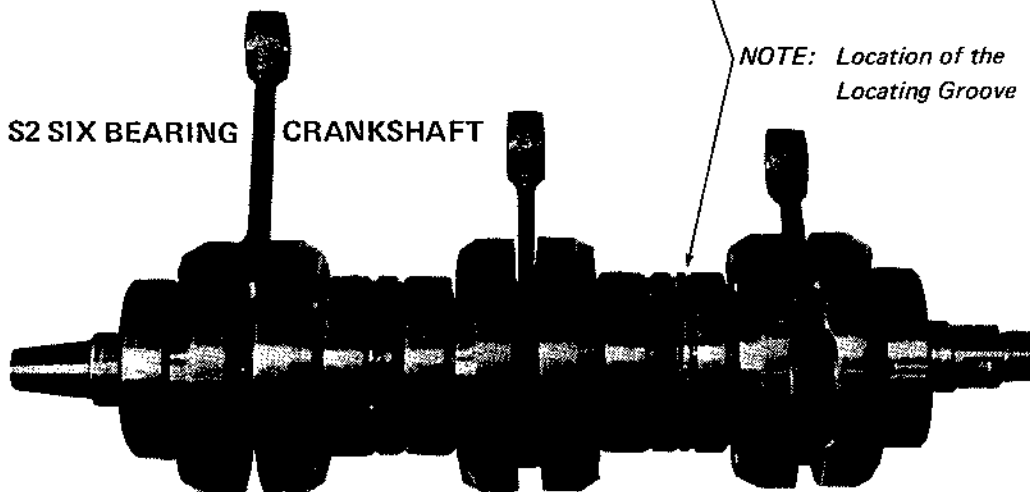
Same as steps 1, 2, and 3 in manual. Install all main bearings and oil receivers.



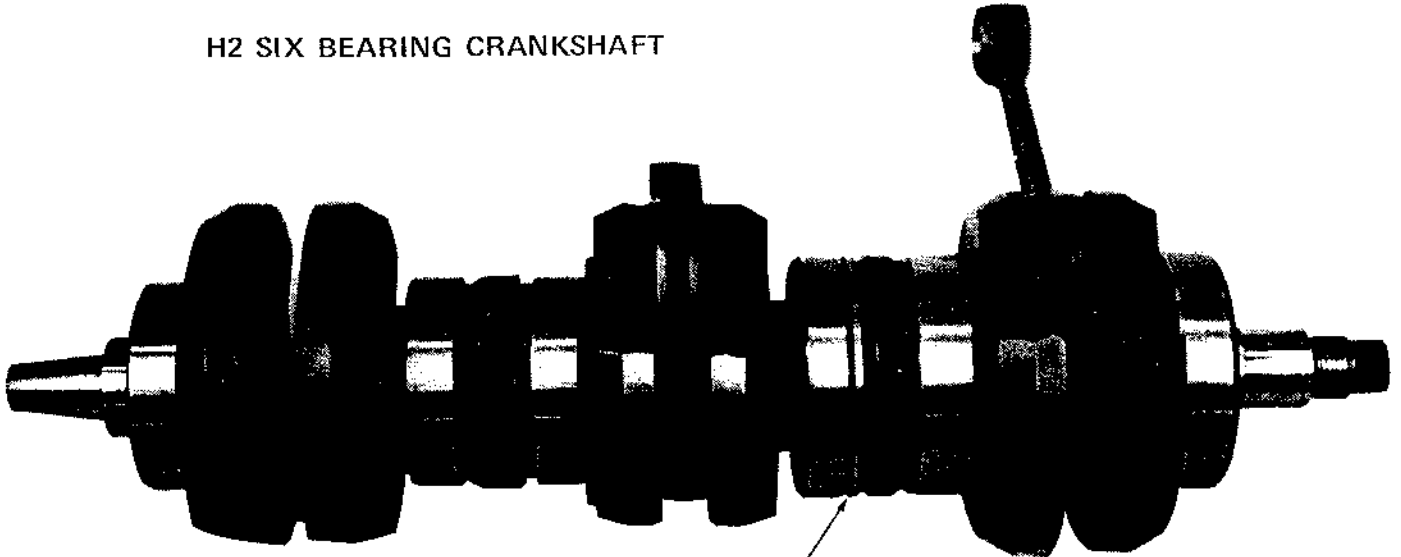
S1 S2 FOUR BEARING CRANKSHAFT



S1 S2 SIX BEARING CRANKSHAFT

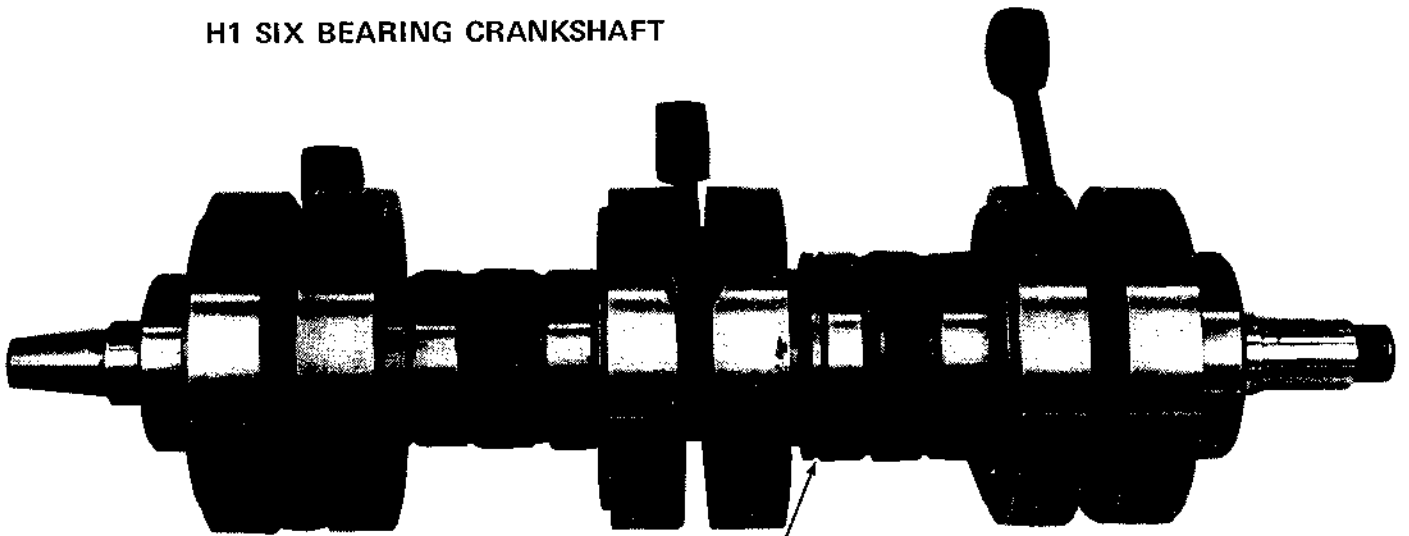


## H2 SIX BEARING CRANKSHAFT



*NOTE: Location of Locating Groove*

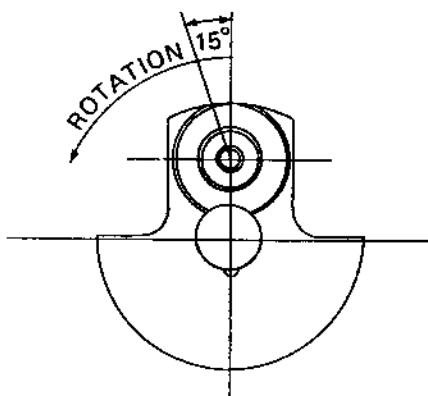
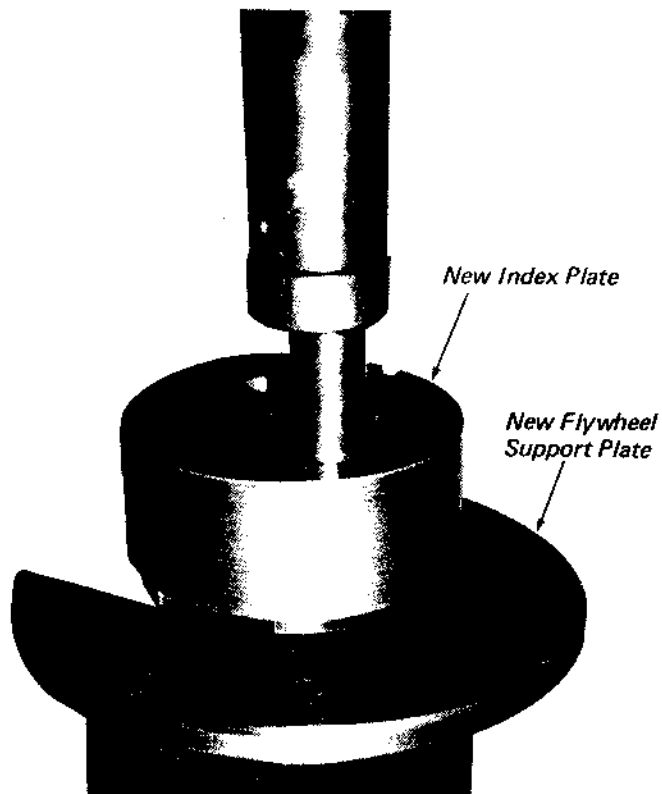
## H1 SIX BEARING CRANKSHAFT



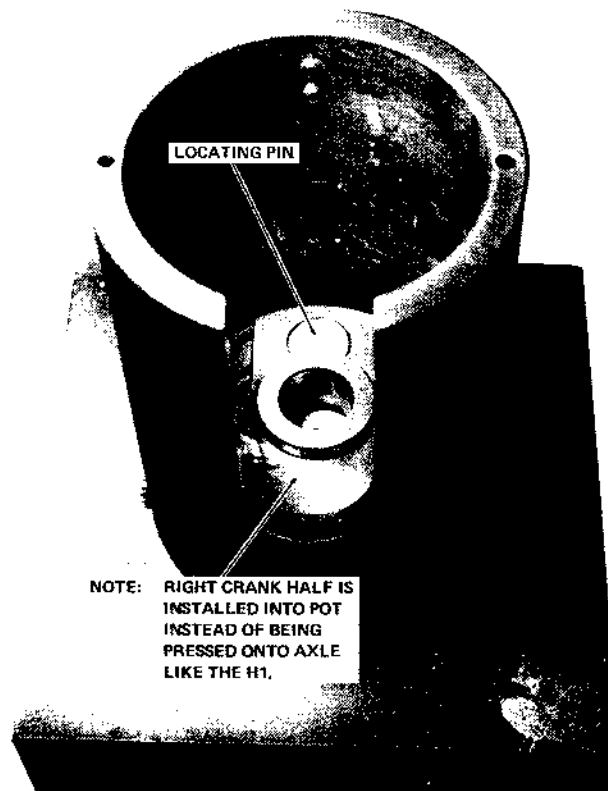
*NOTE: Location of Locating Groove*

## STEP II:

Install all three crankpins into left (oil side) flywheels using manual steps 4 and 5.



## STEP III:



Press left main bearing axle into left cylinder inside flywheel. Next press right main bearing axle into inside right cylinder flywheel. Use manual procedure steps 6, 7, 8, and 9.

**NOTE:** Main bearing axle is pressed down into flywheel. This is just the opposite of H1 procedure.

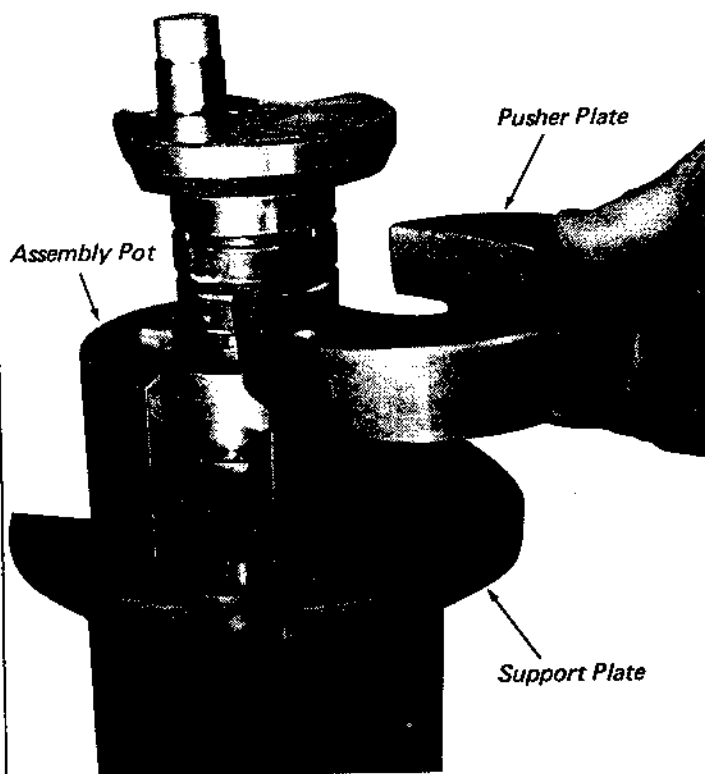


## STEP IV:

Use step 10 and 11 in manual to install new locking pins.

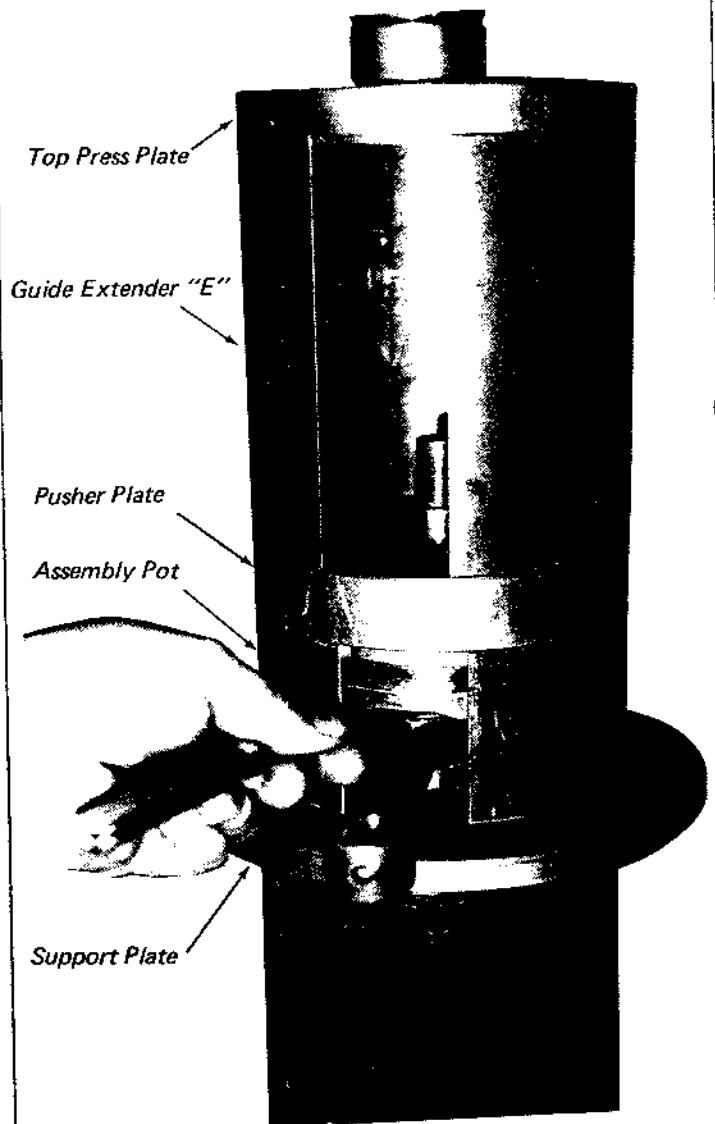
## STEP V:

Press together left cylinder flywheel with con rod assembly. Use new flywheel support plate, flywheel pusher plate, crankshaft guide extender "E" and top press plate.



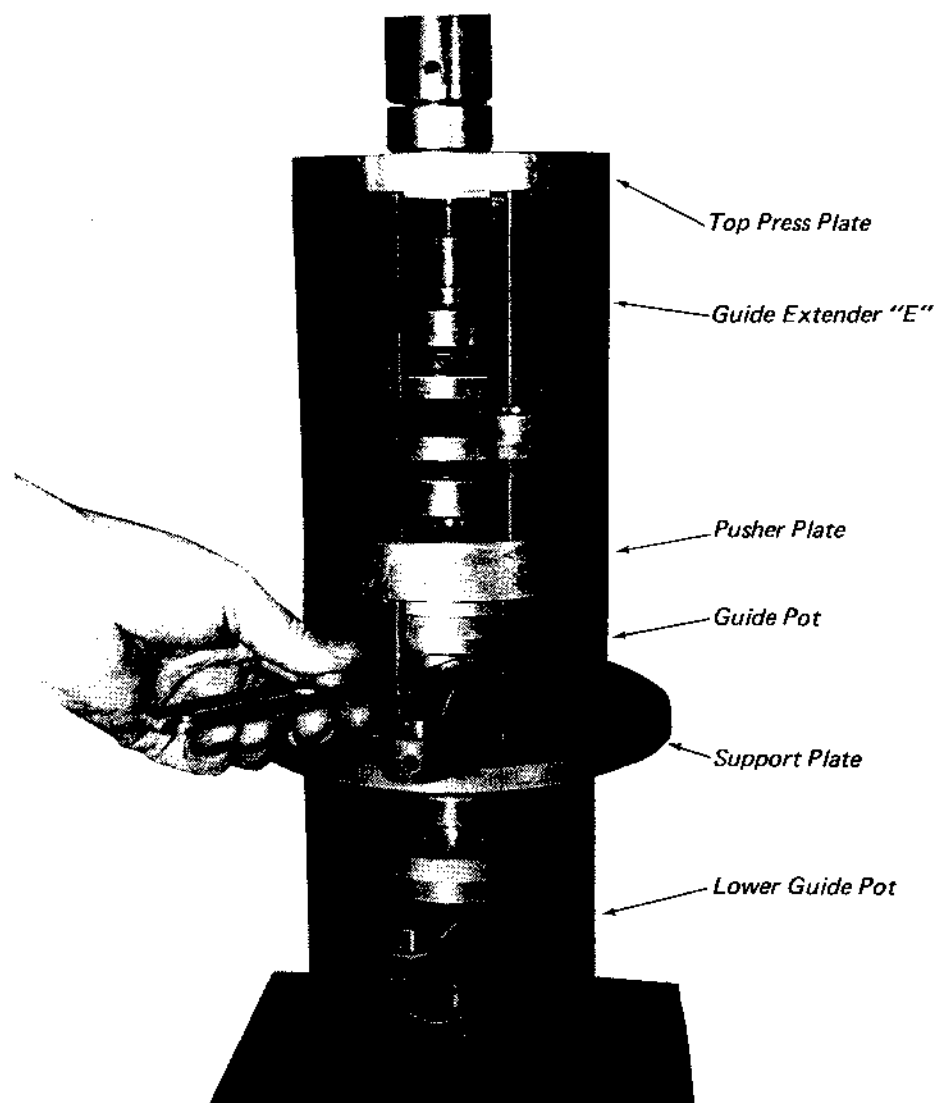
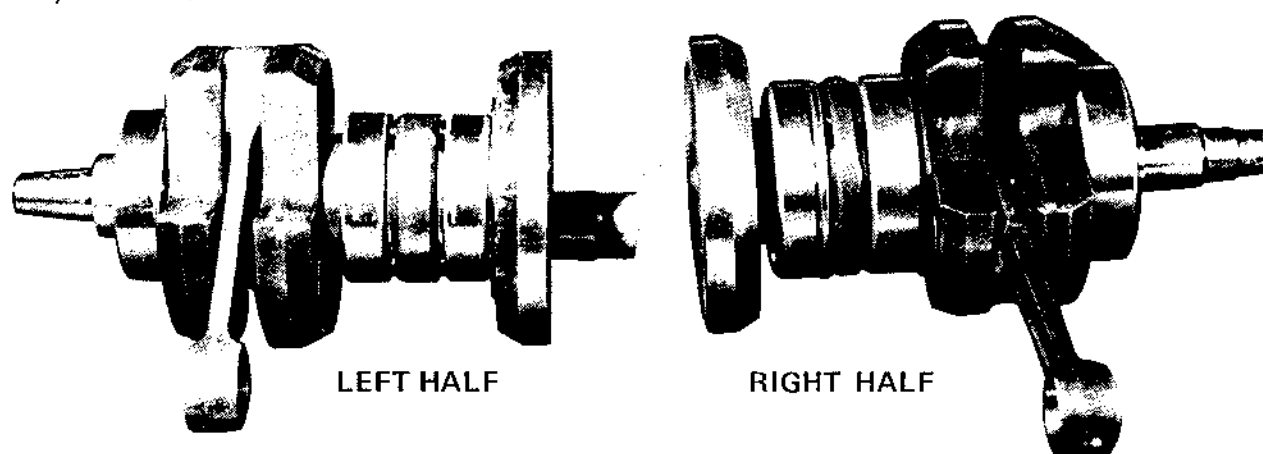
## STEP VI:

Press together right cylinder flywheel with con rod assembly.



## STEP VII:

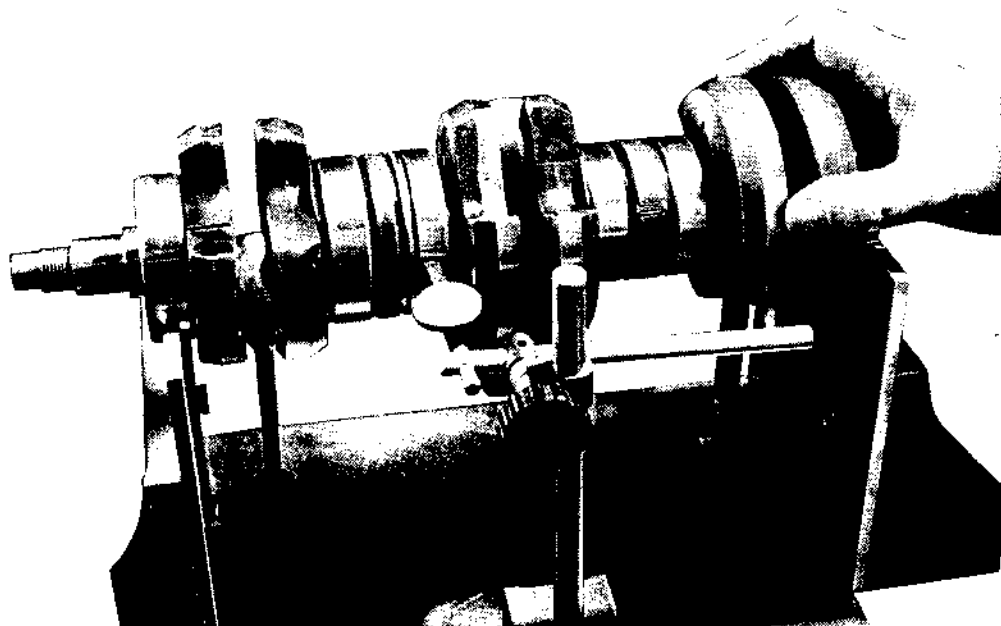
Press right and left cylinder assembly together with center con rod assembly. Crank now completely assembled.





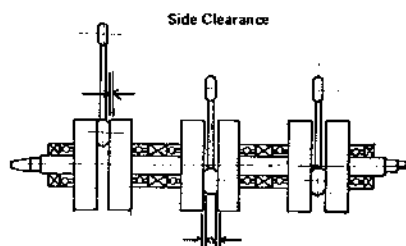
# TRUING PROCEDURE

The truing procedure is the same as in the manual except that the crank is supported by the two outside bearings. The same blocking and wedging of the crank flywheels is used for truing.

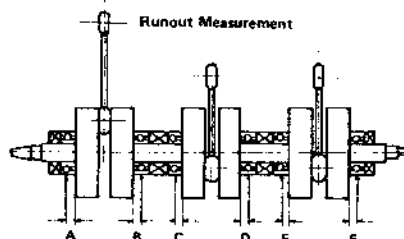


# CRANKSHAFT INSPECTION

There are three inspection steps involved in assuring that the crankshaft is in tolerance to factory specs. It is important that these steps are followed closely to insure smooth operation and long life of the crank.

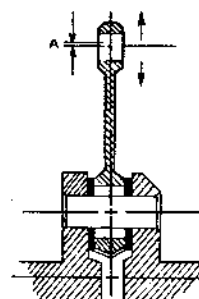


Model	Standard	Service Limit
H1, H2 S1, S2	.0157 - .0197 (0.40 - 0.50 mm)	.0276 in. (0.70 mm)



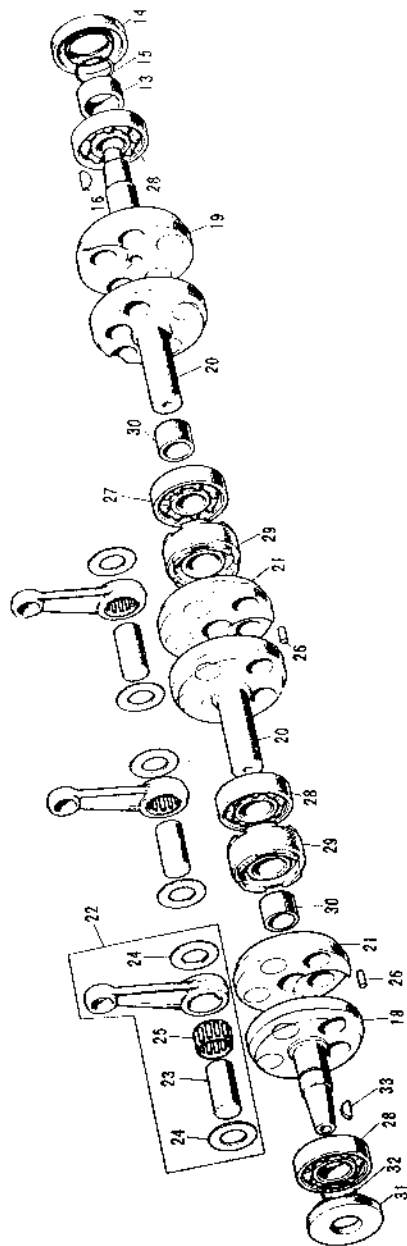
Model	Standard	Maximum
H1, H2	Under .0016 in. (Under 0.040 mm)	.0039 in. (0.10 mm)
Model	Standard	Maximum
S1, S2	.0016 - .0020 in. (0.040 - 0.050 mm)	.0039 in. (0.10 mm)

Big End Radial Clearance



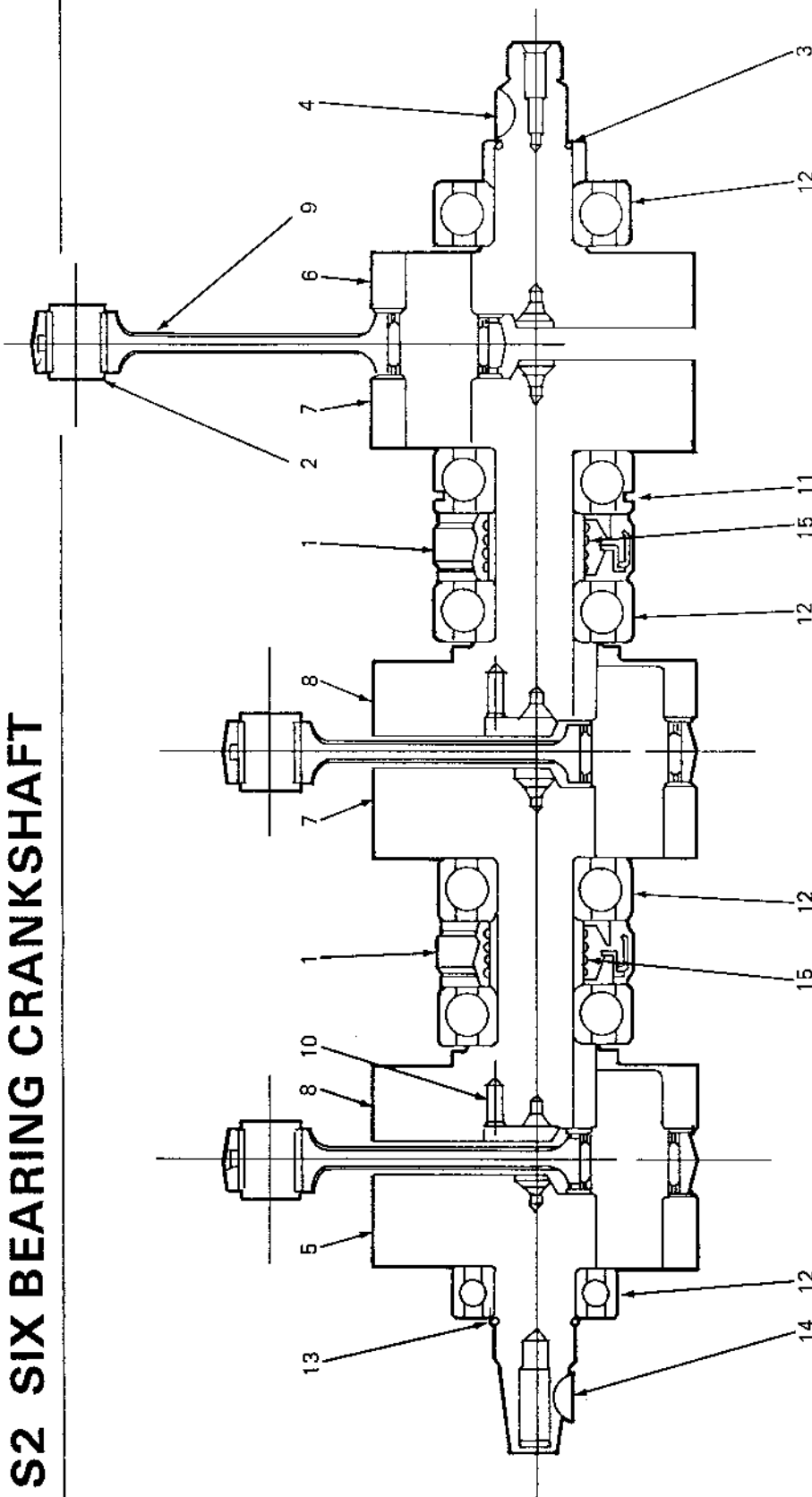
Model	Standard	Limit
S1, S2 H1, H2	.00098 - .00138 in. (0.025 - 0.035 mm)	.0039 in. (0.10 mm)

# S1, S2 FOUR BEARING CRANKSHAFT



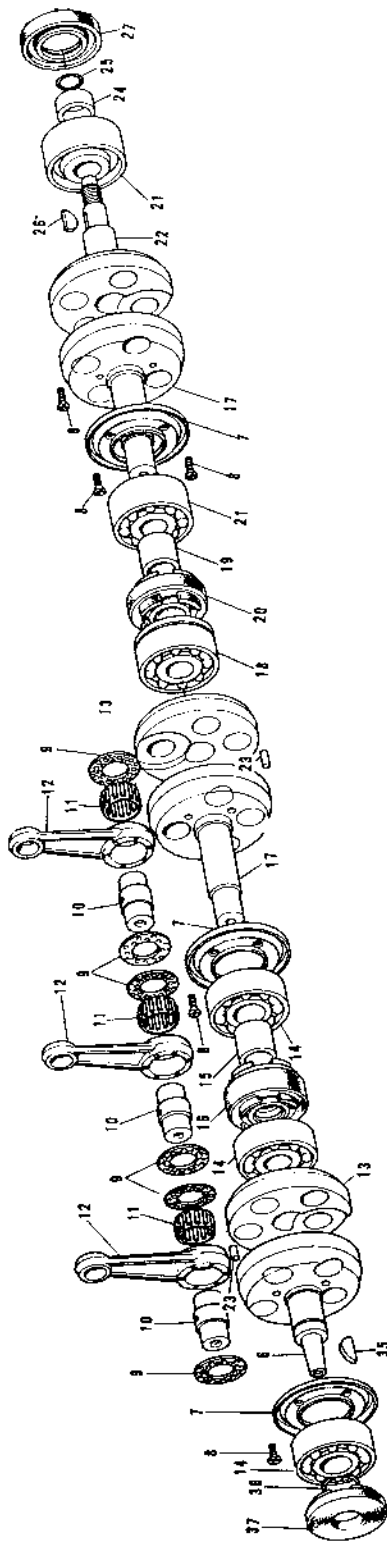
REF. NO.	PART NO.	PART NAME	QUANTITY	REMARKS
13	92027-031	COLLAR - crankshaft	1	
14	92050-023	OIL SEAL, TC326210	1	
15	92055-018	"O" RING, 22 mm	1	
16	92038-015	WOODRUFF KEY	1	
18 ~ 30	13031-037	CRANKSHAFT & CONNECTING ROD ASSY	1	
18	13037-039	CRANKSHAFT, L.H.	1	
19	13038-035	CRANKSHAFT, R.H.	1	
20	13039-008	CRANKSHAFT, CENTER	2	
21	13040-008	CRANKWEB, CENTER	2	
22	13044-018	CONNECTING ROD SET	3	
23	13035-029	CRANK PIN	3	
24	92025-047	WASHER - side	6	
25	13034-027	NEEDLE BEARING - big end	3	
26	610A0512	DOWEL PIN, 5 x 12	2	
27	92045-020	BALL BEARING	1	
28	601B6305	BALL BEARING, #6305	3	
29	92054-011	OIL SEAL, DCY326227	2	
30	92027-078	COLLAR - crankshaft	2	
31	92050-041	OIL SEAL, TCY256210	1	
32	92036-013	CIRCLIP	1	
33	92038-001	WOODRUFF KEY	1	

## S1, S2 SIX BEARING CRANKSHAFT



REF. NO.	PART NO.	PART NAME	REF. NO.	PART NO.	PART NAME
1	92054-016	Oil Seal	9	13044-018	Connecting Rod Set
2	13033-007	Needle Bearing (small end)	10	610A0512	Dowel Pin 5 x 12
3	92055-018	"O" Ring 22 mm	11	92045-020	Ball Bearing
4	92038-015	Woodruff Key	12	601B6305	Ball Bearing
5	13037-039	Crankshaft L.H.	13	92036-013	Circlip
6	13038-035	Crankshaft R.H.	14	92038-001	Woodruff Key
7	13039-008	Crankweb Center	15	92027-158	Collar
8	13040-011	Crankweb Center			

# H2 SIX BEARING CRANKSHAFT



REF. NO.	PART NUMBER	PART NAME	QUANTITY	REMARKS
6 ~ 23	13031-038	CRANK & CONROD ASSY	1	
6	13037-048	CRANKSHAFT, L.H.	1	
7	13045-008	OIL RECEIVER - crankshaft	1 x 3	
8	92012-002	SCREW - countersunk head, 5 x 10	3 x 3	
9	92026-070	WASHER - side	2 x 3	
10	13035-028	CRANK PIN	1 x 3	
11	13034-026	NEEDLE BEARING - big end	1 x 3	71KT002
9 ~ 12	13044-021	CONNECTING ROD SET	1 x 3	
13	13040-010	CRANKWEB, Center	2	
14	601B6206	BEARING - ball, #6206	3	
15	92027-132	COLLAR - crankshaft, L.H.	1	

REF. NO.	PART NUMBER	PART NAME	QUANTITY	REMARKS
16	92054-013	OIL SEAL, Y366219.5	1	
17	13039-010	CRANKSHAFT, Center	2	
18	92045-019	BEARING - ball	1	
19	92027-131	COLLAR - crankshaft, R.H.	1	
20	92054-014	OIL SEAL, Y367213.5	1	
21	601B6306	BEARING - ball, #6306	2	
22	13038-043	CRANKSHAFT, R.H.	1	
23	610A0512	PIN - dowel, 5 x 12	2	
24	92027-133	COLLAR - R.H. crankshaft	1	
25	670B3024	"O" RING, 24 mm	1	
26	510A5100	WOODRUFF KEY	1	
27	92050-043	OIL SEAL, TCY36729	1	
35	92038-001	WOODRUFF KEY	1	
36	92036-019	CIRCLIP	1	
37	92050-042	OIL SEAL, TCY306210	1	